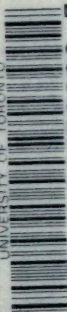


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THE VALUATION OF GENERAL PROPERTY

T. A. O'DONAHUE, M.E., F.G.S.





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THE
VALUATION OF MINERAL PROPERTY

THE VALUATION OF MINERAL PROPERTY RULES AND TABLES

BY

T. A. O'DONAHUE, M.E., F.G.S.

EDITOR OF 'MINING ENGINEERING'

FIRST CLASS CERTIFICATED COLLIERY MANAGER

MEMBER OF THE INSTITUTION OF MINING ENGINEERS

AUTHOR OF 'THE COLLIERY ENGINEERS' POCKET BOOK' 'COLLIERY SURVEYING'

'MINING CALCULATIONS' 'MINING FORMULÆ' ETC.



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PREFACE

SOME time ago the writer concluded that the published tables for discounting deferred values at high rates of interest were not based upon sound principles, and he explained his views in an article in *The Colliery Guardian* (9th February 1906), and later in a paper, 'The Valuation of Mineral Properties,' read before the North of England Institute of Mining Engineers (13th October 1906).

The principle which the writer laid down as giving equitable results is in agreement with a rule given in Mr. George King's admirable treatise, 'The Theory of Finance,' though Mr. King is not disposed to say that the particular conditions premised are alone permissible. The authorities of the Estate Duty Office, however, inform the writer that he correctly gives the objections which they raise to certain tables, and that his rule embodies the principle for which they contend.

It has been suggested that tables should be constructed from the formulæ. To prepare a complete set of tables is a greater task than the writer is willing to undertake. It is possible, however, with the aid of a few of the ordinary interest tables, so to present the formulæ that in their application the necessity for the use of higher mathematics is obviated. This method of supplying the want has been adopted, and by it the calculations can be quickly and easily made.

The formulæ given will be found to be adequate for most requirements, and, with the exception of the additional

rules given for dealing with deferred values, they are in accord with those given in standard works. For deferred values the old rules are also included as some valuers may prefer to use them.

The subject dealt with is a difficult one, and in his treatment of it the writer has endeavoured to be as brief and simple as possible. The student is afforded some guidance as to the mode of procedure in making a valuation, but practical skill and experience are essential for one to attain proficiency.

The writer is indebted to the Council of the Institution of Mining Engineers for allowing him to make use of the paper above referred to, and his thanks are due to the publishers for permission to reproduce from 'Inwood's Tables' those here given.

T. A. O'D.

WIGAN, *January*, 1910.

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VALUATION OF MINERAL PROPERTY

CHAPTER I

INTRODUCTION

THE valuation of a mine or a mineral estate presents unusual difficulties, as the special risks to which the revenue are subject and the peculiar character of the property necessitate the application of certain principles not common to the valuation of other properties. The work which a mining engineer, engaged on a valuation, has to perform is twofold: the first part depends for its worth on the ability and experience of the engineer, and the second part on the accuracy of the actuarial principles applied to determine the value.

General Procedure.—The valuer first estimates the annual revenue that may be derived from the property, and the number of years during which this revenue may be expected to be realised. He next decides upon the rate of interest, which, after due regard to the character of the property, he considers a suitable return for the risk, and then he is in a position to estimate the present value. It follows that, at the end of the term of years fixed for revenue, a mineral estate may be taken as valueless. A colliery frequently may be treated in the same manner, for

the plant at breaking-up prices may have little present value ; and apart from this there are usually obligations to be performed on the termination of the lease, such as the restoration of the surface and other covenants, and the value of the plant may be left to cover them. Should, however, the engineer consider that the plant at the end of the term would have an appreciable value in excess of the obligations due to the lessor, the present value of such sum must be estimated and taken into consideration in the purchase money.

Valuation of Mineral Estates.—Frequently a valuation has to be made on the slenderest foundation, and it is not surprising if the estimate be often very wide of the realised price. Take the case of a mineral estate which can only be worked to a profit by the adjoining colliery. The gross royalty value of the minerals at current prices can be estimated with more or less accuracy ; but if a revenue be not assured by a lease of the mines to the colliery company, an estimate based on a probable prospective revenue may be entirely at fault. Competition generally decides the value of a commodity, but, in this case, there is practically no competition, the ultimate purchaser of the coal must be the colliery company, and they must be depended upon for the revenue. It is, therefore, in their power to dictate terms, and, in the event of these being refused, they can render the estate valueless by leaving the minerals unworked. It is improbable that such an extremity would be resorted to, for if the mines were offered on reasonable terms it would be to the interest of the colliery owners to accept them. But what is more frequently done, when a difficulty about terms arises, is to defer the working of the mines for some time, and, as a consequence, to depreciate their present value. A valuation under such circumstances cannot claim to be precise ; but this objection applies more or less to all valuations

based on high remunerative rates of interest, for the use of a high remunerative rate presupposes uncertainty as to the realisation of profits.

In the case of a mineral estate from which there is no immediate revenue, the engineer with a knowledge of the circumstances forms an estimate of the period which must elapse before revenue commences, and having fixed the probable annual revenue and its term, calculates the present value on the basis of a deferred annuity.

If a more or less definite income be secured by a lease the value of an estate can be estimated within narrower limits. When a lease of a coal mine is granted the consideration is usually a royalty rent, which varies from 3*d.* to 1*s.* a ton, according to the quality of the coal and the particular coal-field in which it is situated. (On cannel-coal, however, the royalty rent may be as much as several shillings per ton.) It is usual also to stipulate for an annual rent of not less than a certain sum, which is termed 'stipulated,' 'certain' or 'minimum' rent.

The royalty rent payable in any one year, or other term fixed for settlement, is the minimum rent or the royalty calculated on the quantity of coal gotten, whichever be the greater. When the minimum rent exceeds the tonnage or footage rent, the amount by which it is in excess is usually recoupable in a subsequent year of the term when such tonnage rent exceeds the minimum rent.

Under such circumstances the minimum rent affords a basis for valuation, but consideration must also be given to the gross royalty value of the coal calculated at the tonnage rate, and to the possibility of the coal being worked more expeditiously than would suffice to meet the minimum rents.

For example take the case of a mineral estate in which the gross royalty value of the minerals is estimated to be £100,000, and say a lease is granted for fifty years.

If the minimum or stipulated rent be such that it will reach the total value of the coal during or at the termination of the period fixed, a valuation may be safely based on the stipulated rents, and the possibility of the minimum rent being exceeded may be ignored, unless such a contingency is highly probable. Usually, however, the sum of the minimum rents will be considerably less than the gross royalty value of the minerals. In the example under consideration say the minimum rent is £1000 per annum. To value the estate the present value of £1000 a year for fifty years is determined, the remunerative rate of interest adopted being dependent upon the financial stability of the lessees. The minimum rents account for half the gross royalty value of the minerals, and there remains a further £50,000 worth of minerals upon which a present value has to be placed. If the obligations of the lessees be limited to the payment of the minimum rents during the term, the whole or part of the £50,000 may remain ungotten and unpaid for, and there is afforded little more data upon which to base a valuation of this portion of the estate than if it had been unsecured by a lease.

A knowledge of the average output of the shafts from which the estates may be worked, of the area and position of other accessible estates, and of the relative value of the various seams will enable the valuer to form an idea as to the period during which these minerals will probably be worked. The remunerative rate of interest to be fixed as the basis of the calculation should be higher than that fixed for the determination of the value of the certain rents, because the latter are to some extent secured.

In many cases it is obligatory for the lessees to pay for all the coal within the term of the lease. With such a condition the £50,000 would be calculated as revenue during the term—possibly towards the termination of the lease.

Valuation of Collieries.—To form an opinion upon the value of a colliery, the engineer requires an estimate of (a) the total quantity of coal available ; (b) the annual output ; (c) the annual profits ; (d) the value of the plant, &c., at the end of the term ; and (e) the cost of fulfilling all obligations at the end of the term. Innumerable points arise for consideration before any satisfactory estimate can be made. To obtain the total quantity of coal available for sale, proper allowance must be made for colliery-consumption, faults, barriers, and pillars which will be required to be left for support : all seams must be included which it is thought may be workable to a profit during the term, although it may be deemed advisable to divide the total life of the colliery into two or more periods, so as to differentiate the profits according to the quality of the seams likely to be worked in each period and the probable cost of getting. The estimate of the annual output may be conditional on the expenditure of a certain sum in development, and this must be allowed for when determining the present value of the colliery. The most important estimate, and the one which it is most difficult to fix, is the profit per ton from which to determine the annual profits. To the ordinary working costs, which must be decided by a consideration of the several seams, must be added the cost of supervision, stores, maintenance of plant, royalties, wayleaves, rates, insurance, compensation for surface damage, &c. To eliminate as much as possible abnormal conditions caused by fluctuations in trade, the selling prices should be based on the average prices realised over a number of years. The total output must be divided into large coal and slack, in the proportion which the characteristics of the seams appear to dictate, so as to obtain the average selling price. The present value of the breaking-up value of the plant must be calculated, and against this must be set the cost of restoring the surface,

royalty payments on abandoned coal, and other costs incidental to winding up.

The original capital may be reduced by the amount recoverable at the end of the term to ascertain the sum which has to be redeemed by the sinking fund ; or a sinking fund may be allowed for, large enough to redeem the original capital, and the present value of the recoverable capital may be calculated at a practicable rate of interest. Theoretically the latter method would be more advantageous to a purchaser, for the sinking fund would be taken at an accumulative rate of interest, and the present value of the recoverable capital would be taken at a slightly higher rate. In practice, however, there would be little difference, for the valuer would be inclined to estimate the recoverable capital at the minimum, if it were accounted as redeemed capital, and would make a more generous estimate if it were to rank as profits.

CHAPTER II

ACCUMULATIVE AND REMUNERATIVE RATES OF INTEREST

Accumulative Rate of Interest.—The positive accumulative rate of capital is decided by the increments due to the interest that can be obtained from an investment in which the principal and interest are absolutely secure. Theoretically no such security exists ; but, for practical purposes, the accumulative rate may be taken to be that rate which may be realised with the greatest possible security. The accumulative rate is not constant, and, like other things, it is influenced by the law of supply and demand.

Remunerative Rate of Interest.—When it is necessary to grant greater profits for the use of capital than the accumulative rate, it is because the capitalist is of opinion that there is some element of risk, and the additional profit is bargained for as insurance. Theoretically the profits from an infinite number of speculative transactions should be, and in practice would be found to be, approximately equal to the accumulative rate obtainable from first-class securities.

The rate of interest to be calculated as the basis of a speculative transaction is divisible into two parts : (1) Interest at the accumulative rate, which is the actual earning power of the principal ; and (2) interest or insurance for the risk taken. It follows, therefore, that *a speculation which yields anything greater than this accumulative rate has*

been successful, no matter how much it falls short of the rate calculated as the basis of the purchase. The writer emphasises this statement because it is one which is often lost sight of. It is frequently stated that a particular industry, because it is of a speculative character, should yield a high remunerative rate of interest, and it is implied that the average yield from the industry should be comparatively high. There is no reason why the average yield—that is interest and sinking fund—from capital invested in an infinite number of speculative transactions should be any higher than that from capital invested in stable industries. When an industry is exceptionally prosperous a readjustment is quickly produced by the influx of capital.

Rates of Interest adopted for Mineral Valuation.—The remunerative rates of interest adopted for the valuation of mineral properties vary between wide limits. For coal-mines in this country, the rate of interest generally ranges from 5 to 10 per cent. A thorough knowledge of the circumstances and experience of similar transactions are necessary to enable the mining engineer to fix, with any degree of accuracy, the rate of interest on which he should base his calculations so as to obtain equitable results.

Rate of Interest affected by the Term.—In some cases the period of revenue should be taken into consideration in fixing the remunerative rate, and the writer desires to call special attention to this point, because it is one which seldom receives attention. If the revenue be subject to the same degree of risk each year of the term, the length of the term does not affect the remunerative rate of interest which should be adopted for the purpose of determining the present value. If, however, the revenue is to a certain extent dependent upon a particular event, the length of the term does affect the rate of interest which should be fixed. As an example take two mineral estates

which adjoin each other, and which have equal probabilities of the minerals being worked. Put the gross value of the first estate at £500, worth say £100 a year for five years, and the second estate at £2000, worth £200 a year for ten years. As the probabilities of the minerals being worked are identical, by the usual practice the same rate of interest would be allowed to a purchaser in each case. Take the rate of interest as 10 per cent., and 3 per cent. as the redemption rate. The present value of the first estate—say bought by 'A'—is £346·8, and the present value of the second estate—bought by 'B'—is £1068·2. Now in a case of this kind the chances of the estates being leased constitute the first and chief risk to the revenue. A purchaser of a mineral estate which has no assured revenue would require say a probable 10 per cent. on his purchase money; but immediately the revenue is partially secured by a lease of the mines for a fixed annual rental, the value of the property is enhanced, and a purchaser could probably be found on a 6 per cent. basis. Assume that the two estates particularised are leased immediately after the purchase. On a 6 per cent. basis the value of A's property is, then, £402·65, and the value of B's is £1358·4. 'A' makes a profit of £55·85, or about 16 per cent. on an outlay of £346·8; and 'B' makes a profit of £290·2, or about 28 per cent. on an outlay of £1064·2. Obviously B's is much the better purchase, because the period of revenue is longer. Of course, if the properties consisted of two collieries, or of two estates secured by leases, the risks would be the same throughout the entire period, and it is not intended that the argument should apply to such cases. Where, however, the revenue is deferred for a long period there is a tendency to increase the remunerative rate of interest, because the revenue is remote, whereas, as has been pointed out, the opposite course should be adopted in some cases.

CHAPTER III

THE REDEMPTION OF THE PRINCIPAL

The Necessity of a Redemption Fund.—The value of a mineral estate is usually estimated on the basis of an annuity certain, the revenue being estimated at a given sum per annum for a fixed term of years. It follows, therefore, that the annuity must be such as not only to afford a purchaser the specified rate of interest on his outlay, but an additional sum for the repayment of part of the purchase money, for he bargains for the return of his capital as well as interest thereon.

The sum to be set aside, as received, to replace the capital is termed the redemption or sinking fund. Generally the proportion of the annuity assumed to be allocated to the sinking fund is such a sum as will amount to the principal at the end of the term, if it be invested as obtained. The total monies placed to the sinking fund is less than the capital, the difference being made up by the accumulations of interest on the fund during the term.

Methods of Dealing with the Redemption Fund.—Formerly it was the practice to assume that the sinking fund increased at the same rate of interest as was allowed on the purchase money, irrespective of whether the stipulated rate of interest was a practicable rate which could be secured by a reasonable investment. If a purchaser stipulates for a high rate of interest to cover risk, the sinking fund should be large enough to ensure the principal being redeemed with the least possible risk, and the rate at which the sinking fund should be assumed to accumulate should,

therefore, be not greater than can be realised from a safe investment. This principle is the one usually adopted and it is the one embodied in the formulæ which are given.

While it is true that, where a high rate of interest is the condition of a transaction, the capital cannot be redeemed at the same rate of interest, there is much to be said for this method of dealing with the problem, for the result is more correct theoretically than would be obtained by allowing a lower rate of interest for the sinking fund. It is usual to allow interest at the stipulated rate on the principal or purchase money during the whole of the term of the annuity, despite the fact that a portion of the principal is redeemed by each payment of the annuity. Strictly, the annuity should provide interest at the stipulated rate on the *out-standing* capital only, and this is, in effect, what is allowed when the redemption fund is calculated as increasing at the stipulated rate of interest.

When one rate of interest only is introduced into the calculation it is immaterial whether the redemption fund is assumed to be set out at interest as obtained, to accumulate to the capital at the end of the term, or whether it is applied at once to reduce the capital; the results are identical. In the latter case subsequent payments of the annuity have of course to provide interest on the reduced capital only, the increasing balances being applied for the liquidation of the capital.

If the latter method be adopted when a high rate of interest is stipulated on the capital, it will be seen that the result is the same as if the redemption fund were assumed to increase at the stipulated rate of interest.

Comparison of Methods.—It is interesting to compare the three methods named by an actual example. Say we have an annuity of £100 for five years, and the rate of interest stipulated as a condition of the purchase is 6 per cent. Find the present value.

(a) The customary method of valuing such an annuity would be to assume that the sinking fund increases at an accumulative rate of interest, say about 3 per cent.

The value under such conditions, allowing the purchaser 6 per cent. on his outlay during the whole of the term, would be £402·65.

The apportionment of the annuity is shown as follows :—

$$\begin{array}{rcl}
 \text{Interest on principal of } £402·65 \text{ at 6 per cent.} & = & £24·159 \\
 \text{Sum required to be invested annually to} & & \\
 \text{amount to } £402·65 \text{ in 5 years at 3 per cent.} & = & 75·841 \\
 \text{Annual revenue} & = & \underline{\underline{£100·000}}
 \end{array}$$

(b) If it be assumed that the sinking fund accumulates at the stipulated rate of 6 per cent., the value of the annuity is £421·236, and the annuity affords—

$$\begin{array}{rcl}
 \text{Interest on } £421·236 \text{ at 6 per cent.} & . & . = £25·2742 \\
 \text{Redemption fund required to produce } £421·236 & & \\
 \text{in 5 years at 6 per cent.} & . & . = 74·7258 \\
 \text{Annual revenue} & = & \underline{\underline{£100·0000}}
 \end{array}$$

(c) Proceeding on the assumption that the capital is reduced at once by each payment of the redemption fund and that interest is allowed on the outstanding capital only, the value is £421·236, as was obtained in (b). The operations of the annuity are as follows :—

1 Year.	2 Annual pay- ments.	3 Outstanding capital previ- ous to annu- ity payment.	4 Interest at 6% on out- standing capital.	5 Redem- tion fund paid each year.	6 Capital paid to date:
1	100	421·236	25·2742	74·7258	74·7258
2	100	346·5102	20·7906	79·2094	153·9352
3	100	267·3008	16·0380	83·9620	237·8972
4	100	183·3388	11·0003	88·9997	316·8969
5	100	94·3391	5·6603	94·3397	421·2366

In the above table the original capital, as shown by column 3, is £421·236. At the end of the first year, when the annuity of £100 is payable, interest at the rate of 6 per cent. is due on £421·236, which absorbs £25·2742 of the annuity. There remains a balance of £74·7258, which is applied to reduce the capital from £421·236 to £346·5102. When the annuity is paid for the second year, interest at the rate of 6 per cent. on £346·5102 absorbs £20·7906, and the balance of the annuity, £79·2094, is again applied to reduce the capital. At the end of the fifth year there remains only £94·3391 outstanding capital, and the annuity provides £5·6603 as interest and £94·3397 to liquidate the debt.

It must be understood that by this method of replacing the capital there is no question of interest on the redemption fund. The sums paid for the redemption of the capital are applied as obtained, and what the purchaser of the annuity does with that portion of his capital which has been redeemed does not concern the annuity transaction.

It will be seen by the two calculations shown in (b) and (c) that a simple method of solving a problem, when interest at the stipulated rate has to be allowed only on the outstanding capital, is to assume that the sinking fund increases at the same rate of interest. Such a method is no doubt misleading, if the purpose for which it is applied be not properly understood. The objection raised to this principle of valuation by Gray and Hoskold, authorities whose writings have had considerable influence on practice, dealt merely with the impossibility of safely redeeming the principal at a high remunerative rate, and gave no consideration to the question of outstanding capital. A rule which gives perfectly logical results has been condemned, apparently under a misapprehension.

The Accepted Principle.—The principle now accepted is

that the purchaser must be allowed interest at the remunerative rate on the whole of the outlay during the entire term—without regard to the fact that a portion of the principal is redeemed each year of revenue—and for the valuation to afford this the redemption fund must be assumed as increasing at a lower rate of interest. It is important that the advantage which a purchaser obtains by this principle should be known to the valuer, so that he may understand exactly what is the value of the remunerative rate of interest which he decides upon.

Anomalous Results of the Formulæ.—It is worthy of note that the accepted method of dealing with the sinking fund produces some anomalous results which cannot well be avoided. To show how these arise, take the following case :—

A purchaser requires an annuity of £100 for ten years, and he stipulates for a remunerative rate of 8 per cent. on his purchase money, the sinking fund to be assumed to accumulate at 3 per cent. He is offered by two parties two annuities, which together comply with his requirement. The first is worth £100 a year for five years, and the second is worth £100 a year for five years, but is deferred five years. Proceeding to value these annuities on the conditions laid down, he finds that the value of the first is £372·6 and the value of the second is £276·9, a total of £649·5. He is, however, not prepared to pay this amount, for he finds that were the two annuities belonging to the one person, when they would be calculated on the basis of £100 a year for ten years, the value would be only £598. If an annuity of £100 for ten years is worth £598, and an annuity of £100 for five years is worth £372·6, an annuity of £100 for five years deferred five years should be worth $£598 - £372·6 = £225·4$, whereas the formula gives it a value of £276·9.

If the second annuity be valued in another way we find that a different result is again obtained. Thus the value

of the deferred annuity at the commencement of the term of revenue must be equal to the present value of the first annuity, viz.: £372·6, and valuing this on the basis of a sum due five years hence, the value is £261·6. For the deferred annuity we have thus obtained three values, viz.: £225·4, £261·6, and £276·9. How are we to reconcile these differences?

Considering the two annuities, the valuation of the immediate annuity is made with the condition that there is to be an annual sinking fund which will redeem the purchase money at the end of the annuity term, viz.: five years, and the transaction is then closed. The deferred annuity is valued with the condition that the purchase money is to be redeemed at the end of the annuity term—ten years from the present date—and the annuity must provide interest at the remunerative rate on the purchase money for the ten years. We thus see that the premised conditions of the two purchases are that £372·6 shall be invested for five years, and then redeemed, and that £276·9 shall be invested for ten years, and then redeemed. To state this in another way the original capital is (£372·6 + £276·9) = £649·5, but after five years £372·6 is redeemed, and the second annuity is required to find interest at the remunerative rate for the remainder of the term on the then outstanding capital only, viz.: £276·9. When the two annuities are taken together and valued as one, the premised condition is that interest at the remunerative rate is provided on the original capital of £598 for the full period, no reduction being allowed at any time for capital already redeemed.

CHAPTER IV

DISCOUNTING DEFERRED VALUES

UNTIL a few years ago the method generally adopted for the valuation of deferred annuities at high rates of interest was to allow the purchaser compound interest at the stipulated rate during the deferred period, and interest at the same rate during the period of revenue on the amount thus accumulated. This stipulation, in the writer's opinion, is erroneous, and cannot be accepted as yielding equitable results. The purchaser of a deferred annuity must be placed in no better and in no worse position than if his purchase were an immediate annuity. The method given above puts a purchaser in a much better position, as is obviously shown when the remunerative rate of interest is high and the deferred period is a long one.

To take the problem in its simplest form, say it is required to find the present value of a sum of money due some years hence. If the rate of interest agreed upon as the basis of the transaction be what may be termed a 'practicable' rate, the present value should be such a sum as would accumulate at compound interest, at the end of the deferred period, to the money due. Should, however, a high rate of interest be stipulated, the purchaser anticipates interest at that rate on his principal; but the accumulations of interest cannot be expected to acquire interest at the high rate, because the interest is not capital risked by the purchaser, and it is therefore not entitled to insurance, but should acquire interest at a practicable rate.

It may be argued that it is entirely a matter of arrangement ; and that the purchaser, knowing the method to be adopted, stipulates for a remunerative rate of interest accordingly. Practically, if the parties to the transaction were able to accurately gauge the conditions, so as to afford comparison with some standard, it would be of no great consequence which method was adopted. The writer, however, is of opinion that to stipulate for compound interest, at a high remunerative rate, is illogical, and that it affords no true basis for comparison and is misleading.

Say a purchase is made on a 10 per cent. basis. Taking the purchase money as £100, if the investment proves as successful as is anticipated and the interest is realised annually, the purchaser obtains a profit of £10 each year. He may use the profits to purchase gilt-edged securities, in which case he would obtain, say, 3 per cent. on them ; or he may speculate again for a 10 per cent. rate of interest. If the second course were followed and proved successful, he would have obtained 10 per cent. compound interest on his principal over the whole of the period. To do this, however, he has had to speculate a second time, and accept the risks of both the first and the second operations. To presuppose a second speculation, without accompanying risk, is illogical ; and, further, a second speculation cannot be admitted in the calculation of the first. The profits must be assumed to accumulate at a rate of interest such as could be safely secured.

The problem may be considered in another way : taking the accumulative rate of capital at 3 per cent., the purchase made on a 10 per cent. basis calculates for 7 per cent. as insurance to cover risk. Again, taking £100 as the purchase money, the accumulative value of the capital at the end of one year is £103. If it be assumed that no interest is realised during the first year, but that the transaction is successfully closed at the end of the second year, the

purchaser is entitled to 10 per cent. interest during the second year on the accumulative amount of his principal, that is to say, 10 per cent. on £103, together with the £10 due for the first year, or, in all, including principal, £120·3; but if interest be paid at the high rate on the accumulative amount of the principal during the second year, he is not entitled to any interest on the £7, the amount of the insurance to cover the risk. The purchaser risks the amount of the principal at the accumulative rate, but the £7 is part of the money for which he has speculated, and whether the purchaser obtains the whole or part of it, depends upon the success of the speculation. It cannot be assumed that this money ranks as capital and is invested in the speculation.

If a man effect a speculation which is to be closed on the same day, his possible loss is limited to his purchase money; and it would be absurd to allow him to increase his shares, in the event of the speculation being successful, by adding to it any portion of the money gained in the speculation. Similarly, the £7 is not money risked nor is it part of the natural accumulative value of the principal; and to calculate interest at the high rate on this amount would be equivalent to giving the purchaser the option of increasing his shares if the speculation were successful, while limiting the losses in the event of failure.

The investor must increase his holding to the extent of the natural increase of the capital at the accumulative rate, but it is not logical to assume that the extra interest, for which the speculation is made, can be invested in the transaction to acquire interest at the remunerative rate. Whether the calculation be based on the assumption that the profits are realised annually during the deferred period and invested to acquire interest at the accumulative rate, or that the remunerative rate of interest is to be allowed on the amount of the capital increased at the accumulative

rate, is immaterial, as both methods are logical and the results are identical. The former method is the way in which the problem is viewed by Mr. George King.* A consideration of the operations of the fund by each method for a number of years will be instructive.

Let it be required to find what sum should be paid four years hence in consideration of a present advance of £100, the remunerative rate of interest being 10 per cent., and the accumulative rate 3 per cent.

(a) By the first method, taking the profits as accumulative—

Principal	£100·00000	
First year's interest	10·00000	
Second year's interest :		
10 per cent. on the principal	£10·00000	
3 per cent. on the previous year's interest	0·30000	
	<hr/>	10·30000
Third year's interest :		
10 per cent. on the principal	£10·00000	
3 per cent. on the accumulated interest, £20·30000	0·60900	
	<hr/>	10·60900
Fourth year's interest :		
10 per cent. on the principal	£10·00000	
3 per cent. on the accumulated interest, £30·90900	0·92727	
	<hr/>	10·92727
The amount due at the end of 4 years being	<hr/>	<u>£141·83627</u>

(b) By the second method, taking the accumulative

* *The Theory of Finance*, by Mr. George King, third edition, 1898, p. 38.

amount of the principal and allowing interest at the remunerative rate on that amount :

Principal	£100·00000
First year's interest	10·00000
Second year's interest: 10 per cent. on the accumulative amount of the principal, £103.	10·30000
Third year's interest: 10 per cent. on the accumulative amount of the principal, the amount of £100 at 3 per cent. for 2 years, or £106·09000	10·60900
Fourth year's interest: 10 per cent. on the accumulative amount of the principal, the amount of £100 at 3 per cent. for 3 years, or £109·2727	10·92727
<hr/>	
The amount due at the end of 4 years being	<u>£141·83627</u>

If compound interest at 10 per cent. were allowed throughout the term, the amount due would be £146·41. The difference in this case is not great, but it increases rapidly with the length of the term.

CHAPTER V

DEFINITIONS

Interest.—Interest is the remuneration paid for the use of capital. The rate of interest is the ratio between the interest and the principal or capital invested. In commercial transactions the interest is generally stated in rate per cent., but for mathematical calculations it will be found to facilitate operations if the interest be converted to rate per unit. Whereas the commercial custom is to give the interest on 100, the interest is required on unity ; and the rate per cent. must, therefore, be divided by 100 to obtain the rate per unit.

The sum of any principal and its interest together is called the *amount*.

If the interest on a loan be calculated on the principal only, for the whole time of the loan, it is said to be *simple* interest. If the principal be increased at fixed periods by the interest then due, and the interest for each succeeding period be calculated on the original principal together with the previous accumulations of interest, it is termed *compound* interest.

Unless otherwise stated, the unit of time for the calculation of interest is one year, and when compound interest is stipulated, the interest is convertible, that is to say, it is added to the principal each year. Strictly speaking, there is no such thing as simple interest, for interest due must have an accumulative value. What is meant, when simple interest is made a conditional term of a loan, is that

the period at which interest becomes convertible is for some longer period than one year. In such a case the annual rate of interest is stated, but it is the *nominal* rate of interest that is given and not the *effective* rate. Thus, if the conditions of a loan were 5 per cent. per annum simple interest for three years, the 5 per cent. is the nominal rate of interest, and it would be more correct to say that the rate of interest was 15 per cent. per three years, the word 'simple' being deleted. Similarly, it frequently happens that a loan is made for compound interest with the condition that the interest is to be convertible at shorter periods than one year. In such a case, the nominal rate of interest per annum is less than will be actually realised. Thus, say the conditions of a loan are 5 per cent. per annum, and the interest is to be paid half yearly; here 5 per cent. is the nominal rate of interest, for if a half year's interest be paid each half year, the actual interest paid is greater than 5 per cent. per annum: for the first half year's payment of interest in any one year may be invested, and interest acquired thereon during the second half of the year. The conditions would have been more correctly stated by fixing the rate of interest as $2\frac{1}{2}$ per cent. per half year.

For the purposes of distinction, the rate of interest which can be obtained on capital invested with a minimum of risk is termed the *accumulative* rate, and when a higher rate of interest is stipulated to cover risk it is termed the *remunerative* rate.

Annuities.—An annuity is a periodical payment amounting to a certain annual sum. The term or *status* of an annuity may be a fixed number of years when the annuity is termed *certain*, or for an uncertain period to be determined by a particular event. An annuity that is to be paid indefinitely is termed a *perpetuity*.

The first payment of an annuity, payable annually, is

assumed to become due at the end of the first year for which the annuity is made, and in the case of a deferred annuity, payable annually, the first payment is assumed to become due one year after the period of deferment. Similarly, if the payments of an annuity have to be made at more frequent intervals than one year, the first payment is assumed to become due at the end of the first period of the term for which the annuity is made.

The measure of an annuity is the total amount payable in one year, irrespective of how frequently instalments of the annuity are payable.

If it be required that the first payment of an annuity be payable at the beginning of the term, it is called an annuity *due*.

Redemption or Sinking Fund.—The terms of purchase of an annuity certain must be such that the annuity will provide not merely interest on the outlay at the stipulated rate, but also such additional sum as will, if invested as obtained, amount to the principal at the end of the term. The amount which must be periodically set aside to redeem the principal is termed the sinking or redemption fund.

CHAPTER VI

RULES AND EXAMPLES

I. The Amount of £1 in n Years.

If the principal be £1 and the interest be at the rate of r per £ per annum, the amount to which the principal accumulates in one year will be $1 + r$, and if this amount be invested for another year at the rate r , its amount at the end of the second year will be $(1 + r)(1 + r)$ or $(1 + r)^2$; and, generally, £1 invested at the rate r , compound interest, for n years, will amount to $(1 + r)^n$.

Where r = interest on 1, or rate per cent. divided by 100

n = the term of years

R^n = the amount of 1 in n years at rate r —

$$R^n = (1 + r)^n \quad . \quad . \quad . \quad (1)$$

(a) Example.—What is the amount of £1000 in 8 years at 4 per cent. compound interest?

$$r = 4 \div 100 = 0.04$$

$$\text{The amount of 1} = (1 + 0.04)^8 = 1.04^8$$

$$1.04 = \log .017033$$

$$\log .017033 \times 8 = \log .136264 = 1.3685$$

$$1.04^8 = 1.3685$$

$$\text{The amount of £1} = £1.3685$$

$$\text{and the amount of £1000} = \underline{\underline{£1368.5}}$$

The amount of £1 in 8 years at 4 per cent. as given by the table is £1.36857.

If the interest is to be calculated for a unit of time other than one year, that is to say, if the interest is to be convertible at greater or less frequent periods than one year, the same principle holds. Thus, say the interest is realised m times per year, the interest for each unit of time being r/m (where r is the nominal rate of interest for a year).

Then the amount of £1 in one year is $\left(1 + \frac{r}{m}\right)^m$ and

$$R^{nm} = \left(1 + \frac{r}{m}\right)^{mn} \quad . \quad . \quad . \quad (1a)$$

where r = the nominal rate of interest for one year

m = the times per year the interest is convertible

R^{nm} = the amount of 1 in n years, interest convertible m times a year.

(b) Example.—What is the amount of £1000 in 8 years at 4 per cent. per annum, the interest being convertible half yearly.

(It should be noted that 4 per cent. per annum is the nominal rate of interest, the effective rate of interest being 2 per cent. per half year.)

$$r = 4 \div 100 = 0.04, \quad m = 2, \quad \text{and} \quad r \div m = 0.02$$

$$\text{The amount of } \pounds 1 \text{ for 8 years} = (1 + 0.02)^{2 \times 8} = 1.02^{16}$$

$$1.02 = \log .0086002$$

$$1.02^{16} = \log .0086002 \times 16$$

$$= \log .1376032 = 1.3728$$

$$\text{The amount of } \pounds 1 = \pounds 1.3728$$

$$\text{and the amount of } \pounds 1000 = \underline{\pounds 1372.8}$$

It is obvious that a nominal rate of 4 per cent. per annum convertible half yearly for 8 years, amounts to the same as 2 per cent. per annum for 16 years. The value of £1 for 16 years at 2 per cent. from the table is £1.37279.

II. The Amount of £1 Per Annum in n Years.

As the first payment of an annuity payable annually becomes due at the end of the first year, the amount of an annuity of 1 at the end of the first year is 1; at the end of the second year the annuity amounts to $1 + (1 + r)$; at the end of the third year to $1 + (1 + r) + (1 + r)^2$; and, generally, the amount of the annuity of 1 in n years equals

$$1 + (1 + r) + (1 + r)^2 + \dots + (1 + r)^{n-1} = \frac{(1 + r)^n - 1}{r}$$

Where r = interest on 1 for 1 year

R^n = the amount of 1 in n years at the rate r
or $(1 + r)^n$

A_n = the amount of 1 per annum in n years

$$A_n = \frac{R^n - 1}{r} \quad (2)$$

(a) Example.—What is the amount of £100 per annum in 8 years at 4 per cent. ?

$$r = 4 \div 100 = 0.04$$

$$R^n = (1 + 0.04)^8 = 1.04^8$$

$$\text{The amount of 1 per annum} = \frac{1.04^8 - 1}{0.04}$$

$$1.04 = \log .0170333$$

$$1.04^8 = \log .0170333 \times 8$$

$$= \log .1362664 = 1.3686$$

$$\frac{1.3686 - 1}{0.04} = \frac{.3686}{0.04} = 9.215$$

$$\text{The amount of £1 per annum} = £9.215$$

$$\text{and the amount of £100 per annum} = \underline{\underline{£921.5}}$$

The amount of 1 as given by the table will be seen to be £9.21423.

If the annuity be payable by equal instalments m times a year, and the interest be convertible at the same intervals—

Where r = the nominal rate of interest on 1 for 1 year

m = the times per year the interest is convertible

R^{nm} = the amount of 1 in n years, interest convertible m times a year

A_{nm} = the amount of 1 per annum in n years

$$A_{nm} = \frac{\left(1 + \frac{r}{m}\right)^{nm} - 1}{r} \quad \text{or} \quad \frac{R^{nm} - 1}{r} \quad . \quad . \quad (2a)$$

(b) Example.—What is the amount of an annuity of £100, payable half yearly, in 8 years at 4 per cent. ?

$$\text{The amount of 1 per annum} = \frac{\left(1 + \frac{.04}{2}\right)^{8 \times 2} - 1}{0.04}$$

$$= \frac{1.02^{16} - 1}{0.04}$$

$$1.02 = \log .0086002$$

$$1.02^{16} = \log .0086002 \times 16$$

$$= \log .1376032 = 1.3728$$

$$\text{The amount of 1 per annum} = \frac{1.3728 - 1}{0.04} = £9.32$$

$$\text{and the amount of £100 per annum} = \underline{\underline{£932}}$$

The amount of £1 per annum, payable half yearly, in 8 years at 4 per cent. is the same as the amount of 10s. per annum in 16 years at 2 per cent. The amount of 1 per annum for 16 years at 2 per cent. as given by the table = 18.63928, and one half of this, viz. : 9.31964, is the amount of 1 per annum, payable half yearly, in 8 years at 4 per cent.

III. The Present Value of a Perpetuity.

A principal of 1 invested at rate r will yield an annuity of r indefinitely. Therefore,

where r = interest on 1 for one year

$$\text{the value of a perpetuity of 1} = \frac{1}{r} \quad (3)$$

The value of a perpetuity of 1 at 4 per cent. is 1 divided by 0.04 or 25.

IV. The Value of a Deferred Perpetuity.

A principal of 1 invested at the rate r will amount in n years to R^n , and if this be invested it will yield $r \times R^n$ indefinitely. Therefore,

where r = the interest on 1 for 1 year

n = the number of years that the perpetuity is deferred

R^n = the amount of 1 in n years at the rate r , or $(1 + r)^n$

$$\text{The value of a perpetuity of 1 deferred } n \text{ years} = \frac{1}{r \times R^n} \quad (4)$$

Example.—What is the value of a perpetuity of £10 deferred 4 years at 4 per cent. ?

$$r = 0.04 \text{ and } R^n = 1.04^4$$

$$\text{Value of 1} = \frac{1}{0.04 \times 1.04^4}$$

$$1.04 = \log \quad 0.0170333$$

$$1.04^4 = \log \quad 0.0170333 \times 4 = \log \quad 0.0681332$$

$$0.04 = \log \quad 2.6020600$$

$$0.04 \times 1.04^4 = \log \quad 2.6701932$$

$$1 = \log \quad 0.0000000$$

$$0.04 \times 1.04^4 = \log \quad 2.6701932$$

$$1 \div (0.04 \times 1.04^4) = \log \quad 1.3298068 = 21.370$$

The value of deferred perpetuity of £1 = £21.37

The value of deferred perpetuity of £10 = £213.7

Checking this result by the table giving the value of R^n we have the amount of 1 in 4 years at 4 per cent. = 1.16986.

$$\text{Value of 1} = \frac{1}{0.04 \times 1.16986} = \frac{1}{0.0467944} = 21.3701$$

V. The Present Value of £1 due n Years hence.

1. At one rate of interest.

A principal of 1 invested at the rate r for one year amounts to $1+r$; and, consequently, 1 is the present value of $1+r$ due one year hence. Therefore the present value of 1 due a year hence is $\frac{1}{1+r}$. Similarly, as $(1+r)^n$ is the amount of 1 in n years, it follows that 1 is the present value of $(1+r)^n$ due n years hence.

Where r = the interest on 1 for one year

n = the term of years

R^n = the amount of 1 at the rate r in n years or $(1+r)^n$

and V_n = the present value of 1 due n years hence :

$$V_n = \frac{1}{(1+r)^n} \quad \text{or} \quad \frac{1}{R^n} \quad . \quad . \quad (5)$$

(a) Example.—What is the present value of £600 due 8 years hence at 4 per cent. per annum ?

$$r = 4 \div 100 = .04$$

$$R^n = 1.04^8$$

$$\text{Present value of 1} = \frac{1}{1.04^8}$$

$$1.04^8 = \log .0170333 \times 8 = \log .1362664$$

$$1 = \log .0000000$$

$$1.04^8 = \log .1362664$$

$$1 \div 1.04^8 = \log .8637336 = .73069$$

$$\text{Present value of 1} = £0.73069$$

$$\text{Present value of £600} = 600 \times .73069 = \underline{\underline{£438.414}}$$

The present value of 1 due 8 years hence at 4 per cent. as given by the table is .73069.

2. *At two rates of interest.*

The above rule, (5), is frequently used when a high remunerative rate is stipulated, and most if not all the published tables are based on this principle, but, in the writer's opinion, it is correct only when the rate of interest taken as the basis of the calculation is approximately the accumulative rate. If the nature of the transaction be such that a high rate of interest has to be allowed for remuneration, the rule ceases to give equitable results. The principle on which the calculation should be based is to place the purchaser of the deferred payment in the same position at the end of the term as that in which he would be if he had invested his capital in operations involving the same element of risk as the deferred payment and yielding interest annually. Assuming that such operations were successful, he would have realised the remunerative rate of interest on his capital each year, and these profits could be invested as obtained, so as to increase at an accumulative rate. This is the principle upon which the following rule is constructed.

If s be the remunerative rate of interest and r the accumulative rate, the amount of s per annum in n years, by rule 2, is $s \times \frac{R^n - 1}{r}$ or $s \times A_n$. Taking the principal as unity, to find the amount of the principal under these conditions, 1 must be added to the amount of the interest. Thus the amount of 1 in n years is $1 + s \times \frac{R^n - 1}{r}$ or $1 + s \times A_n$. The reciprocal of this expression gives the present value of 1 due n years hence. Therefore,

where r = accumulative rate of interest
 s = the remunerative rate of interest

R^n = the amount of 1 in n years at the rate r or
 $(1 + r)^n$

A_n = amount of 1 per annum in n years at rate r
 the present value of 1 in n years

$$= \frac{1}{1 + s \times \frac{R^n - 1}{r}} \quad \text{or} \quad \frac{1}{1 + s \times A_n} \quad (6)$$

(b) Example.—What is the present value of £1000 due 12 years hence, allowing a purchaser 10 per cent. on his outlay, and accumulating the interest at 3 per cent.?

The remunerative rate of interest, s , = $10 \div 100 = 0.1$

The accumulative rate of interest, r , = $3 \div 100 = 0.03$

The amount, R^n , of 1 in 12 years at

3 per cent. $= (1 + .03)^{12} = 1.03^{12}$

The present value of 1 = $\frac{1}{1 + 0.1 \times \frac{1.03^{12} - 1}{0.03}}$

$$1.03 = \log .0128372$$

$$1.03^{12} = \log .0128372 \times 12$$

$$= \log .1540464 = 1.42576$$

Present value of 1 = $\frac{1}{1 + 0.1 \times \frac{1.42576 - 1}{.03}} = \frac{1}{2.4192}$

$$1 = \log .000000$$

$$2.4192 = \log .383672$$

$$1 \div 2.4192 = \log 1.616328 = .41336$$

$$\text{Present value of 1} = .41336$$

$$\text{Present value of 1000} = \underline{\underline{£413.36}}$$

Checking this result by the tables giving the value of A_n , we have the amount of 1 per annum for 12 years at 3 per cent. as 14.192.

$$\text{Present value of 1} = \frac{1}{1 + 0.1 \times 14.192} = \frac{1}{2.4192}$$

$$\text{and } 1 \div 2.4192 = .41336$$

If in the above example the interest were assumed to accumulate at the remunerative rate of 10 per cent., instead of at the accumulative rate of 3 per cent., the present value as found by rule 5 would be £318·63.

The following statements showing the accumulations of the principals explain more clearly the difference between the two methods :—

By rule 5.

Principal	£318·63
Interest at 10 per cent. on £318·63 = £31·863, and the amount of £31·863 per annum for 12 years at 10 per cent. = $31·863 \times$ $21·3843$	681·37
	<hr/>
	<u>£1000·00</u>

By rule 6.

Principal	£413·36
Interest at 10 per cent. on £413·36 = £41·336, and the amount of £41·336 per annum for 12 years at 3 per cent. = $41·336 \times 14·192$	586·64
	<hr/>
	<u>£1000·00</u>

VI. Redemption or Sinking Fund.

Rule 2 gives the amount of 1 per annum in n years, hence the reciprocal of that expression will give the fund which must be invested annually at the rate r to amount to 1 in n years.

Where r = the interest on 1 for 1 year

R^n = the amount of 1 in n years or $(1 + r)^n$

A_n = the amount of 1 per annum in n years

F_n = the redemption fund per annum that will amount to 1 in n years

$$F_n = \frac{r}{R^n - 1} \quad \text{or} \quad \frac{1}{A_n} \quad . \quad . \quad . \quad (7)$$

(a) Example.—What redemption or sinking fund must be invested annually at 3 per cent. to redeem £200 in 20 years?

$$r = 3 \div 100 = 0.03$$

$$R^n = (1 + .03)^{20} = 1.03^{20}$$

$$1.03 = \log .0128372$$

$$1.03^{20} = \log .0128372 \times 20 = \log .256744 = 1.8061$$

$$\frac{0.03}{1.8061 - 1} = \frac{0.03}{0.8061} = .0372$$

$$\text{Sinking fund for } \pounds 1 = \pounds 0.0372$$

$$\text{Sinking fund for } \pounds 200 = (200 \times .0372) = \underline{\pounds 7.44}$$

Checking this result by the table giving the value of A_n we have 26.87037 as the amount of 1 per annum for 20 years at 3 per cent., and

$$\frac{1}{A_n} = \frac{1}{26.87037} = 0.037216$$

which agrees with the figures in the table giving the value of F_n .

Should the interest on the redemption fund be invested m times per annum, and the interest be convertible m times per annum, the reciprocal of the rule 2a must be applied. The redemption fund per annum, the interest being convertible m times per year, is—

$$F_{nm} = \frac{r}{\left(1 + \frac{r}{m}\right)^{nm} - 1} \quad \text{or} \quad \frac{r}{R^{nm} - 1} \quad \text{or} \quad \frac{1}{A_{nm}} \quad . \quad (7a)$$

(b) Example.—What annual sinking fund will amount to £200 in 20 years at 3 per cent., the sinking fund being invested half yearly, and the interest being convertible at the same intervals?

The sinking fund for 1 is—

$$\frac{0.03}{\left(1 + \frac{0.03}{2}\right)^{20 \times 2} - 1} = \frac{0.03}{1.015^{40} - 1}$$

$$1.015 = \log .006466$$

$$1.015^{40} = \log .006466 \times 40 = \log .25864 = 1.814$$

$$\frac{0.03}{1.814 - 1} = \frac{0.03}{0.814} = .03686$$

Annual sinking fund for £1 = .03686

Annual sinking fund for £200 = $(200 \times .03686) = \underline{\underline{£7.372}}$

The sinking fund which must be invested each *half year* at 3 per cent. for 20 years to produce £1 will be the same as would be required to be invested each year at $1\frac{1}{2}$ per cent. for 40 years to produce £1. For the latter the table gives .018427, and this multiplied by 2 gives £.036854, the required annual fund to produce £1.

VII.—The Present Value of an Annuity.

I. *At one rate of interest.*

The amount, A_n , of an annuity of 1 in n years was shown by rule 2 to be $\frac{R^n - 1}{r}$. The present value of such an annuity must be such a sum as would, if invested at the rate r for n years, be equal to the amount of the annuity. Taking the present value as P , the amount of P at the rate r in n years equals $P \times R^n$; and $P \times R^n = \frac{R^n - 1}{r}$

Where r = interest on 1 for 1 year

n = the term of years

R^n = the amount of 1 at the rate r in n years or $(1 + r)^n$

A_n = the amount of 1 per annum in n years

V_n = the present value of 1 due n years hence

and P_n = the present value of the annuity

$$P_n = \frac{R^n - 1}{R^n \times r} \quad \text{or} \quad \frac{A_n}{R^n} \quad \text{or} \quad \frac{1 - V_n}{r} \quad (8)$$

(a) Example.—What is the present value of an annuity of £100 for 8 years, allowing interest at 3 per cent. ?

$$r = 3 \div 100 = 0.03$$

$$R^n = 1.03^8$$

$$\text{Present value of annuity of 1} = \frac{1.03^8 - 1}{1.03^8 \times 0.03}$$

$$1.03 = \log .0128372$$

$$1.03^8 = \log .0128372 \times 8 = \log .1026976 = 1.2668$$

Present value of annuity of 1

$$= \frac{1.2668 - 1}{1.2668 \times 0.03} = \frac{.2668}{.038004} = 7.02$$

Present value of annuity of £100 = £702

Taking the values of A_n and R^n from the tables we have

$$\text{Present value of annuity of 1} = \frac{A_n}{R^n} = \frac{8.89234}{1.26677} = 7.0197$$

Taking the third form of the equation and obtaining the value of V_n from the tables we have $V_n = 0.78941$, and

Present value of annuity of 1

$$= \frac{1 - 0.78941}{0.03} = \frac{0.21059}{0.03} = 7.0197$$

The present value of an annuity of 1 for 8 years at 3 per cent. is also given by the tables as 7.01969.

2. At two rates of interest.

In the rule given above, the redemption fund is assumed to accumulate at the same rate of interest as is calculated

on the principal. When a high rate of interest is taken as the remunerative rate on the principal, and interest is to be allowed on the principal during the entire term, the rule will not apply, as the redemption fund could not be invested with safety to acquire interest at the same rate. With such conditions, it is necessary to assume that the redemption fund accumulates at another and lower rate of interest.

Taking the present value of an annuity as P and the remunerative rate of interest allowed on the principal as s , the annuity must be such as will yield $P \times s$; and, in addition, a sufficient sum for the redemption fund, such as will redeem the principal at a lower rate of interest, r . The redemption fund that will redeem P in n years was

shown by rule 7 to be $P \times \frac{r}{R^n - 1}$. Therefore, the annuity
 $= P \left(\frac{r}{R^n - 1} + s \right)$; and for an annuity of 1,

where s = the remunerative rate of interest on the principal

r = the rate of interest on the sinking fund

n = the term of years

F_n = the sinking fund

R^n = the amount of 1 in n years at the rate r , or
 $(1 + r)^n$

and P_n = the present value

$$P_n = \frac{1}{\frac{r}{R^n - 1} + s} \quad \text{or} \quad \frac{1}{F_n + s} \quad (9)$$

(b) Example.—What is the present value of £100 per annum for 12 years, allowing interest on capital at 8 per cent., the redemption fund being assumed to accumulate at 3 per cent.?

The remunerative rate of interest is 8 per cent., and $s = 0.08$; the accumulative rate of interest is 3 per cent. and $r = 0.03$; the present value, P , of an annuity of 1

$$= \frac{1}{\frac{0.03}{1.03^{12} - 1} + 0.08}$$

$$1.03 = \log .0128372$$

$$1.03^{12} = \log .0128372 \times 12 = \log .1540464 = 1.42576$$

therefore the present value of an annuity of 1 is—

$$\frac{1}{\frac{0.03}{1.42576 - 1} + 0.08} \text{ or } 6.6462$$

and the present value of an annuity of £100 is £664.62.

Checking this by the tables we find that the sinking fund, which will amount to 1 in 12 years at 3 per cent., = .070462, and the present value of 1

$$= \frac{1}{F_n + s} = \frac{1}{.070462 + 0.08} = \frac{1}{.150462} = 6.6462$$

If the annuity be payable by equal instalments m times per year and the interest be convertible at like intervals; where s is the nominal remunerative rate of interest per annum; r , the nominal rate of interest per annum on the redemption fund; n , the term of years; and m , the number of times per annum that the instalments of the annuity are payable and the interest on the redemption fund is convertible, the present value of an annuity of 1 is—

$$\frac{1}{\frac{r}{\left(1 + \frac{r}{m}\right)^{nm} - 1} + s} \text{ or } \frac{1}{F_{nm} + s} \quad (9a)$$

(c) Example.—What is the value of an annuity of £100 for 8 years, payable half yearly, allowing a purchaser 10 per cent. interest and redeeming the principal

at 4 per cent., the interest on the redemption fund being convertible half yearly ?

The rate $s = 10 \div 100$ or 0.10

$$r = 4 \div 100 \text{ or } 0.04$$

$$m = 2$$

$$\frac{r}{m} = \frac{0.04}{2} \text{ or } 0.02$$

$$1.02 = \log .0086002$$

$$\begin{aligned} 1.02^{8 \times 2} &= 1.02^{16} = \log .0086002 \times 16 \\ &= \log .1376032 = 1.37278 \end{aligned}$$

The present value of an annuity of 1

$$\begin{aligned} &= \frac{1}{\frac{0.04}{(1 + 0.02)^{8 \times 2} - 1} + 0.10} = \frac{1}{\frac{0.04}{1.37278 - 1} + 0.10} \\ &= \frac{1}{0.1073 + 0.10} = 4.82392 \end{aligned}$$

and the present value of an annuity of £100 is £482.392.

The sinking fund, which must be invested half yearly to produce 1 in 8 years at 4 per cent., is identical with the amount which must be invested annually to produce 1 in 16 years at 2 per cent. Taking the value of the latter from the table we have 0.05365 which, multiplied by 2 = .1073, the annual sinking fund F_{nm} .

The value of an annuity of 1

$$= \frac{1}{F_{nm} + s} = \frac{1}{.1073 + 0.10} = 4.82392$$

An examination of the operations of the fund will show more clearly what the calculation allows. To redeem a principal of 1 by half-yearly investments at 4 per cent., with the interest convertible half yearly, requires an annual

sinking fund of $\frac{0.04}{(1 + 0.02)^{8 \times 2} - 1}$ or 0.107300. The redemption of the purchase money requires a sinking fund of 482.392×0.107300 or £51.76076; the provision of 10 per

cent. interest on the purchase money requires £48·2392 ; making a total of £99·99996. The annuity of £100 therefore meets these conditions. It should, however, be noted that the £48·2392, provided by the annuity as interest on the principal, is payable by half-yearly instalments, therefore the actual rate of interest is 5 per cent. per half year, an effective rate of rather more than 10 per cent. per annum. The 10 per cent. is the nominal rate of interest, and is so defined in the formula.

VIII.—The Present Value of a Deferred Annuity.

1. *At one rate of interest.*

The present value, P_n , of an immediate annuity of 1 for n years was shown by rule 8 to be $\frac{R^n - 1}{R^n \times r}$, and the present value, V_d , of 1 due d years hence was shown by rule 5 to be $\frac{1}{R^d}$, therefore the present value of an annuity of 1 for n years deferred d years

$$= \frac{1}{R^d} \times \frac{R^n - 1}{R^n \times r} \quad \text{or} \quad V_d \times P_n \quad \text{or} \quad P_{n+d} - P_d \quad (10)$$

where r = the interest on 1 for 1 year

R^n = the amount of 1 at the rate r in n years or $(1 + r)^n$

R^d = the amount of 1 at the rate r in d years or $(1 + r)^d$

V_d = the present value of 1 due d years hence at the rate r

P_n = the present value of an immediate annuity of 1 for n years at the rate r

P_d = the present value of an immediate annuity of 1 for d years at the rate r

and P_{n+d} = the present value of an immediate annuity of 1 for $n + d$ years at the rate r

Example.—An annuity of £100 for 10 years at 3 per cent. is deferred 5 years, what is the present value?

$$\begin{aligned}\text{Present value of } 1 &= \frac{1}{(1 + .03)^5} \times \frac{(1 + .03)^{10} - 1}{(1 + .03)^{10} \times .03} \\ &= \frac{1}{1.03^5} \times \frac{1.03^{10} - 1}{1.03^{10} \times 0.03}\end{aligned}$$

$$1.03 = \log .0128372$$

$$1.03^5 = \log .0128372 \times 5 = \log .064186$$

$$1 = \log .000000$$

$$1.03^5 = \log .064186$$

$$1 \div 1.03^5 = \log \bar{1}.935814 = .86261$$

$$\begin{aligned}1.03^{10} &= \log .0128372 \times 10 = \log .128372 \\ &= 1.34392\end{aligned}$$

$$\frac{1.03^{10} - 1}{1.03^{10} \times 0.03} = \frac{1.34392 - 1}{1.34392 \times 0.03} = \frac{.34392}{.0403176} = \log \bar{1}.536457$$

$$\log \bar{1}.536457 = \log 2.605494$$

$$\log .930963$$

$$\log .930963 = 8.5302$$

$$\log \bar{1}.935814 = .86261$$

$$\log .866777 = 8.5302 \times .86261 = 7.358$$

Present value of deferred annuity of £1 = £7.358

Present value of deferred annuity of £100 = £735.8

Taking the third form of the equation, and obtaining the values from the tables, we have—

P_{n+d} = Present value of an annuity of 1 for

(10 + 5) 15 years at 3 per cent. . = 11.93794

P_d = Present value of an annuity of 1 for

5 years at 3 per cent. . . . = 4.57971

Present value of annuity of 1 for 10 years de-

ferred 5 years, at 3 per cent. . = 7.35823

The above rule is based on the assumption that the sinking fund is invested to accumulate at the same rate of interest as is allowed on the capital. When a high remunerative rate of interest is stipulated as a condition

of the purchase, and interest is to be allowed on the principal during the entire term, the sinking fund should be calculated at a practicable rate of interest, and it is therefore necessary to have two rates of interest in the calculation.

2. *At two rates of interest. (Old Rule.)*

The following rule, which the writer contends does not give equitable results, is based on the assumption that compound interest at the higher or remunerative rate is allowed on the purchase money during the deferred period, and interest at the same rate during the term of the annuity on the amount thus accumulated. The sinking fund is assumed to accumulate at another rate of interest.

The value of an immediate annuity of 1 where two rates of interest are involved was shown by rule 9 to be $\frac{1}{\frac{r}{R^n - 1} + s}$

If P be the present value of a deferred annuity of 1, the amount of P at the end of the deferred period where compound interest at the remunerative rate is allowed = $P \times (1 + s)^d$, which represents the value of the annuity of 1 at the commencement of the annuity term.

Therefore $P \times (1 + s)^d = \frac{1}{\frac{r}{R^n - 1} + s}$ and the present value

of a deferred annuity of 1

$$= \frac{1}{(1 + s)^d \left(\frac{r}{R^n - 1} + s \right)} \quad \text{or} \quad \frac{1}{(1 + s)^d (F_n + s)} \quad (11)$$

where s = the remunerative rate of interest on 1

r = the accumulative rate of interest on 1

n = the term of the annuity

d = the term of deferment

R^n = the amount of 1 in n years at rate r or $(1 + r)^n$

and F_n = the sinking fund which will amount to 1 in n years at rate r .

Example.—What is the present value of £100 per annum for 20 years, deferred 10 years, allowing a purchaser 15 per cent. interest and redeeming capital at 3 per cent.?

$$\text{Present value of } 1 = \frac{1}{(1 + .15)^{10} \left(\frac{.03}{1.03^{20} - 1} + .15 \right)}$$

$$1.15 = \log .0606978$$

$$1.15^{10} = \log .0606978 \times 10 = \log \underline{.606978}$$

$$1.03 = \log .0128372$$

$$1.03^{20} = \log .0128372 \times 20 = \log .256744 \\ = 1.80611$$

$$1.80611 - 1 = .80611 = \log 1.9063943$$

$$.03 = \log 2.4771213$$

$$.80611 = \log \underline{1.9063943}$$

$$.03 \div .80611 = \log 2.5707270 = .037216$$

$$.037216 + .15 = .187216 = \log 1.2723429$$

$$1.15^{10} = \log .606978$$

$$.187216 = \log \underline{1.2723429}$$

$$1.15^{10} \times .187216 = \log 1.8793209$$

$$1 = \log .0000000$$

$$\log \underline{1.8793209}$$

$$\log 1.206791 = 1.3203 \text{ present value of } 1.$$

$$\text{Present value of annuity of } £100 = \underline{£132.03}$$

The following statement showing the operations of the annuity will explain more clearly the conditions premised in the rule.

$$\text{Principal invested} \quad . \quad . \quad . \quad . \quad . \quad = \quad £132.032$$

Interest (compound) at the rate of 15 per cent.

$$\text{per annum for 10 years} \quad . \quad . \quad . \quad = \quad \underline{402.110}$$

The amount of the principal at the end of the

$$\text{deferred period is therefore} \quad . \quad . \quad \underline{£534.142}$$

When the term of revenue commences:

Interest at the rate of 15 per cent. is to be	
provided on £534·142	= £80·12
And sinking fund to produce £534·142 in	
20 years at 3 per cent.	= 19·88
The annuity being	<u>£100·00</u>

3. *At two rates of interest. (New Rule.)*

As has been previously stated, when a high rate of interest is allowed on the principal, the payments of the interest should be assumed to accumulate at another and lower rate. Where P is the present value of an annuity of 1, the amount of P and its accumulated interest at the

end of a term of n years is $P \left(1 + s \times \frac{R^n - 1}{r} \right)$, where s is

the remunerative rate of interest and r the accumulative rate of interest (see deduction of rule 6). The amount of an annuity of 1 for n years at the rate r was shown by rule

2 to be $\frac{R^n - 1}{r}$. The amount of the principal and its

accumulated interest at the end of the term should be equal to the amount of the annuity, and, consequently,

$P \left(1 + s \times \frac{R^n - 1}{r} \right) = \frac{R^n - 1}{r}$. This equation can be shown

to be identical with the equation 9, giving the present value of an immediate annuity, which is as it should be, as the amount of the principal has been taken for exactly the same period as the term of the annuity. The problem which is under present consideration, however, is that of a deferred annuity, and if d be the period of deferment the amount of P and its accumulated interest in $n + d$ years is

$P \left(1 + s \times \frac{R^{n+d} - 1}{r} \right)$, and this must be equal to $\frac{R^n - 1}{r}$,

the amount of the annuity.

Therefore—

where s = the remunerative rate of interest

r = the accumulative rate of interest

n = the term of the annuity

d = the term of deferment

R^n = the amount of 1 in n years at rate r or $(1 + r)^n$

R^{n+d} = the amount of 1 in $n+d$ years at rate r or $(1 + r)^{n+d}$

A_n = the amount of 1 per annum in n years at rate r

and A_{n+d} = the amount of 1 per annum in $n+d$ years at rate r

$$\text{the present value} = \frac{\frac{R^n - 1}{r}}{1 + s \times \frac{R^{n+d} - 1}{r}} \text{ or } \frac{A_n}{1 + s \times A_{n+d}} \quad (12)$$

Example.—What is the present value of £100 per annum for 20 years, deferred 10 years, allowing a purchaser 15 per cent. on his outlay, and redeeming the purchase money at 3 per cent., the interest during the deferred period being assumed to accumulate at 3 per cent. ?

$$s = 15 \div 100 = 0.15 \text{ and } r = 3 \div 100 = 0.03$$

$$\text{Present value of annuity of 1} = \frac{\frac{1.03^{20} - 1}{0.03}}{1 + 0.15 \times \frac{1.03^{20+10} - 1}{0.03}}$$

$$1.03 = \log .0128372$$

$$1.03^{20} = \log .0128372 \times 20 = \log .256744 = 1.80611$$

$$1.03^{20+10} = 1.03^{30} = \log .0128372 \times 30 = \log .385116 = 2.42726$$

Substituting the values thus found we have—

$$\begin{aligned} \frac{\frac{1.80611 - 1}{0.03}}{1 + 0.15 \times \frac{2.42726 - 1}{0.03}} &= \frac{\frac{.80611}{0.03}}{1 + \frac{0.15 \times 1.42726}{0.03}} \\ &= \frac{26.87037}{8.13631} = 3.3025 \end{aligned}$$

The present value of annuity of 1 = 3.3025
 The present value of annuity of £100 = £330.25

If the tables be used to find the values of A_n and A_{n+d} we have when $n=20$ and $n+d=30$

$$\text{Present value of annuity of 1} = \frac{A_n}{1 + s A_{n+d}} =$$

$$\frac{26.87037}{1 + .15 \times 47.57542} = \frac{26.87037}{8.13631} = 3.3025$$

To enable a comparison to be made with the preceding example, and to show clearly the principle on which the last formula has been constructed, assume that £330.25 has been invested under the conditions stated—

Principal	£330.250
Interest at the rate of 15 per cent. on £330.250 equals £49.537, and £49.537 per annum for 10 years at 3 per cent. amounts to . . .	<u>567.892</u>
The amount of the principal at the end of the deferred period is therefore . . .	<u>£898.142</u>

When the term of revenue commences—

Interest at the rate of 15 per cent. must be provided on the outlay	£49.537
Interest at the rate of 3 per cent. on the amount, £567.892, to which the interest has accumulated	17.037
Sinking fund to produce £330.25 in 20 years at 3 per cent.	12.291
And there remains, to produce the £567.892 of interest accumulated during the deferred period, a sinking fund of	21.135

The annuity being . . £100.000

If the annuity be payable by equal instalments m times in a year and the interest be assumed to be convertible at the same intervals, where P is the present value of an annuity of 1 the amount of P and its accumulated interest at the end of a term of $n + d$ years equals

$$P \left(1 + s \frac{\left(1 + \frac{r}{m} \right)^{(n+d)m} - 1}{r} \right)$$

where s is the nominal remunerative rate of interest, and r is the nominal accumulative rate (see deduction to rules 2a and 12). The amount of an annuity of 1 for n years under like conditions is—

$$\frac{\left(1 + \frac{r}{m} \right)^{nm} - 1}{r}$$

Therefore the present value, P , of a deferred annuity of 1

$$\begin{aligned} & \frac{\left(1 + \frac{r}{m} \right)^{nm} - 1}{r} \\ = & \frac{\frac{\left(1 + \frac{r}{m} \right)^{nm} - 1}{r}}{1 + s \frac{\left(1 + \frac{r}{m} \right)^{(n+d)m} - 1}{r}} \quad \text{or} \quad \frac{A_{nm}}{1 + s A_{(n+d)m}} \cdot (12a) \end{aligned}$$

where s = nominal remunerative rate of interest per annum on 1

r = nominal accumulative rate of interest per annum on 1

n = term of annuity

d = term of deferment

m = times per annum interest is convertible and annuity payable

A_{nm} = the amount of 1 per annum for n years, interest convertible m times per annum at rate r

$A_{(n+d)m}$ = the amount of 1 per annum for $n + d$ years,
interest convertible m times per annum at rate r

Example.—What is the present value of an annuity of £100 payable half yearly for 12 years, deferred 3 years, allowing interest on the principal at the nominal rate of 10 per cent. per annum, and an accumulative rate of 4 per cent. per annum, the interest being convertible half yearly?

$$r = 4 \div 100 = 0.04, s = 10 \div 100 = 0.10, \text{ and } m = 2$$

The present value of annuity of 1

$$\begin{aligned} & \frac{\left(1 + \frac{.04}{2}\right)^{12 \times 2} - 1}{.04} \\ &= \frac{.04}{\left(1 + \frac{.04}{2}\right)^{(12+3) \times 2} - 1} \\ &= \frac{1.02^{24} - 1}{.04} \div \frac{1.60844 - 1}{.04} \\ &= \frac{1.02^{30} - 1}{.04} \div \frac{1.81136 - 1}{.04} \\ &= \frac{.60844}{.04} \div \frac{.81136}{.04} = \frac{15.211}{3.0284} = 5.0224 \end{aligned}$$

The present value of an annuity of 1 = 5.0224
and the present value of an annuity of £100 = £502.24

Using the second form of the equation and employing the tables to obtain the values of A_{nm} and $A_{(n+d)m}$ we have—

A_{nm} = the amount of 1 per annum for 12 years at 4 per cent. convertible half yearly,

$A_{(n+d)m}$ = the amount of 1 per annum for 15 years at 4 per cent. convertible half yearly.

The amount of £1 per annum for 12 years at 4 per cent. convertible half yearly is equivalent to 10s. per annum for 24 years at 2 per cent. which is seen to be $(30.42186 \div 2) = 15.21093$.

Similarly the amount of 1 per annum for 15 years at 4 per cent. convertible half yearly is half the amount of 1 per annum at 2 per cent. for 30 years or $(40.56808 \div 2) = 20.28404$.

$$\begin{aligned} \text{Present value of annuity of 1} &= \frac{15.21093}{1 + 0.10 \times 20.28404} \\ &= \frac{15.21093}{3.028404} = 5.0224 \end{aligned}$$

To ascertain the present value of an annuity, many engineers ignore the fact that the annuity may be payable half yearly or quarterly, and they do not seriously err in so doing. Certainly it is unwise to assume that the sinking fund may be invested to obtain interest convertible at more than twice a year, for such a condition is not reasonably practicable.

If in the example given above the annuity be valued on the basis that the annuity is paid by one instalment annually and that the sinking fund is invested at an actual rate of 4 per cent. per annum, the present value is £500.46, showing a difference of £1.78 as compared with the more precise valuation previously made.

CHAPTER VII

MISCELLANEOUS EXAMPLES

ILLUSTRATING THE USE OF THE TABLES

The Present Value of an Annuity.—(1) The gross value of coal in a mineral estate is estimated at £15,000, which is considered to be worth £500 a year for 30 years. Required the present value, allowing a purchaser 10 per cent. on his outlay and redeeming the principal at 3 per cent.

By rule 9.

$$\text{Present value of annuity of 1 for } n \text{ years} = \frac{1}{F_n + s}$$

$$\text{Remunerative rate of interest} = 10 \text{ per cent.}$$

$$\text{and } s = 10 \div 100 = 0.1$$

In the example F_n is the annual sinking fund which will produce 1 in 30 years at 3 per cent.; given by the tables as .021019

$$\text{Present value of annuity of 1} = 1 \div (.021019 + 0.1) = 8.26315$$

$$\text{Present value of annuity of } £500 = 8.26315 \times 500 = £4131.575$$

The Present Value of a Deferred Annuity.—(2) Take the example given above of an annuity of £500 a year for 30 years, but assume that the annuity is deferred for 5 years. Required the present value, allowing a purchaser 10 per cent. on his outlay during the whole period of 35 years, calculating the interest as accumulating during the deferred period at the rate of 3 per cent., and taking the interest on the redemption fund at 3 per cent.

By rule 12.

$$\text{Present value of deferred annuity of } 1 = \frac{A_n}{1 + s \times A_{n+d}}$$

The remunerative rate of interest = 10 per cent.,
and $s = 10 \div 100 = 0.1$

A_n = The amount of 1 per annum in 30 years at 3 per cent.; given by the tables as 47.57542

A_{n+d} = The amount of 1 per annum in 35 years at 3 per cent.; given by the tables as 60.46208

Therefore the present value of deferred annuity of 1

$$= \frac{47.57542}{1 + 0.1 \times 60.46208} = \frac{47.57542}{7.046208} = 6.75192$$

Present value of annuity of £500 = $6.75192 \times 500 = £3,375.96$

The Present Value of an Annuity Payable Half Yearly.—

(3) The certain rent reserved by a lease is £100 per annum payable half yearly, and the term is 20 years. Required the present value of the rents, allowing a purchaser a nominal rate of 10 per cent. on his outlay, and redeeming the principal at a nominal rate of 4 per cent. The interest on the sinking fund is assumed to be convertible half yearly. By rule 9a.

The present value of an annuity of 1 payable m times per annum = $\frac{1}{F_{nm} + s}$.

The remunerative rate of interest is 10 per cent., and $s = 10 \div 100 = 0.1$.

F_{nm} = the annual sinking fund, which will amount to 1 in 20 years at 4 per cent., interest being convertible half yearly.

The sinking fund which if invested half yearly will amount to 1 in 20 years at 4 per cent. is the same as that which will amount to 1 if invested annually for 40 years at

2 per cent. The sinking fund which will produce 1 in 40 years at 2 per cent. is given by the tables as .016556. As this is the amount required to be set aside each half year the annual sinking fund = $.016556 \times 2 = .033112$.

Therefore the present value of the annuity of 1

$$= \frac{1}{.033112 + 0.1} = \frac{1}{.133112} = 7.51247$$

The present value of the annuity of £1000 = £7,512.47

(Had the calculation been made on the assumption that the interest was convertible annually, the present value would have been £7,486.)

The Present Value of a Deferred Annuity Payable Half Yearly.—(4) Take the example given above but assume that the annuity is deferred 5 years. Required the present value.

By rule 12a.

Present value of deferred annuity of 1 payable m times

$$\text{per annum} = \frac{A_{nm}}{1 + s \times A_{(n+d)m}}$$

$s = 0.1$ as before

A_{nm} = the amount of 1 per annum for 20 years invested half yearly at 4 per cent., which is equivalent to half the amount of 1 invested annually for 40 years at 2 per cent. The tables give the amount of 1 per annum for 40 years at 2 per cent. as 60.40198, so that the amount required is $60.40198 \div 2 = 30.20099$. Similarly $A_{(n+d)m}$ = the amount of 1 per annum for $(20 + 5)$ 25 years invested half yearly at 4 per cent., which is equivalent to half the amount of 1 per annum invested annually for 50 years at 2 per cent.

The amount of 1 per annum for 50 years at 2 per cent.

is given by the tables as 84·5794, so that the amount required is $84\cdot5794 \div 2 = 42\cdot2897$.

$$\begin{aligned}\text{Therefore the present value of } 1 &= \frac{30\cdot20099}{1 + 0\cdot1 \times 42\cdot2897} \\ &= \frac{30\cdot20099}{5\cdot22897} = 5\cdot77570\end{aligned}$$

and the present value of £1000 = £5.775·70

The Valuation of a Mineral Estate.—(5) The gross royalty value of the minerals in an estate is estimated to be £100,000. A lease has been granted for a term of 40 years, the stipulated rents being, 1st year £300, 2nd year £400, 3rd year £600, 4th year £700, 5th and each succeeding year £1000. The engineer is of opinion that the stipulated rents will not be exceeded during the first half of the term, but that an excess royalty of £1000 per annum may be expected during the last 20 years of the term. These estimates account for minerals to the amount of £58,000, and the £42,000 worth of minerals remaining he estimates on the basis of a re-lease for 21 years at £2000 per annum. Required the value of the estate at the commencement of the lease term.

The revenue is subject to three degrees of risk, and the purchaser bargains for the following remunerative rates of interest :

(a) On the stipulated rents, for payment of which there is the security of the lessees, 6 per cent.,

(b) On the estimated rents in excess of the stipulated rents during the lease term, 8 per cent.; and

(c) On the estimated rents of the re-lease, 10 per cent.

The accumulative rate of interest to be taken as 3 per cent.

(a) The stipulated rent for each of the first 4 years of the term may be valued as a deferred payment, and the

stipulated rents during the remainder of the term as a deferred annuity.

By rule 6.

$$\text{The present value of 1 due } n \text{ years hence} = \frac{1}{1 + s \times A_n}$$

where s = remunerative rate of interest on 1 = $6 \div 100 = .06$

A_n = the amount of 1 per annum in n years at the accumulative rate of interest, viz. : 3 per cent.

The tables give the following values for A_n :—

When $n = 1$ year, $A_n = 1$

„ $n = 2$ years, $A_n = 2.03$

„ $n = 3$ years, $A_n = 3.30909$

and „ $n = 4$ years, $A_n = 4.18363$

The present value of £300 due 1 year hence

$$= \frac{1}{1 + .06 \times 1} \times 300 = \underline{\underline{£283.018}}$$

The present value of £400 due 2 years hence

$$= \frac{1}{1 + .06 \times 2.03} \times 400 = \underline{\underline{£356.569}}$$

The present value of £600 due 3 years hence

$$= \frac{1}{1 + .06 \times 3.30909} \times 600 = \underline{\underline{£506.135}}$$

The present value of £700 due 4 years hence

$$= \frac{1}{1 + .06 \times 4.18363} \times 700 = \underline{\underline{£559.545}}$$

Present value of first 4 years' rents = £1705.267

The subsequent stipulated rents form an annuity of £1000 a year for 36 years deferred 4 years.

By rule 12.

$$\text{Present value of deferred annuity of } 1 = \frac{A_n}{1 + s \times A_{n+d}}$$

In the example

$$s = 6 \div 100 = .06$$

$$A_n = \begin{array}{l} \text{The amount of } 1 \text{ per annum for } 36 \\ \text{years at } 3 \text{ per cent. ; given by the} \\ \text{tables as} \end{array} \quad 63.27594$$

$$A_{n+d} = \begin{array}{l} \text{The amount of } 1 \text{ per annum for } (36+4) \\ \text{40 years at } 3 \text{ per cent. ; given by} \\ \text{the tables as} \end{array} \quad 75.40126$$

Present value of the deferred annuity of 1

$$= \frac{63.27594}{1 + .06 \times 75.40126} = 11.4545$$

Present value of the deferred annuity of £1000 = £11,454.5

Present value of all stipulated rents

$$= 1,705.267 + 11,454.5 = £13,159.767$$

(b) To find the present value of the estimated excess royalty rents during the lease term. £1000 per annum for 20 years deferred 20 years at 8 per cent. and 3 per cent.

By rule 12 ; given above.

$$s = 8 \div 100 = .08$$

$$A_n = \begin{array}{l} \text{The amount of } 1 \text{ per annum for } 20 \\ \text{years at } 3 \text{ per cent. ; given by the} \\ \text{tables as} \end{array} \quad 26.87037$$

$$A_{n+d} = \begin{array}{l} \text{The amount of } 1 \text{ per annum for } (20+20) \\ \text{40 years at } 3 \text{ per cent. ; given by} \\ \text{the tables as} \end{array} \quad 75.40126$$

The present value of the deferred annuity of 1

$$= \frac{26.87037}{1 + .08 \times 75.40126} = 3.82110$$

and the present value of the deferred annuity

$$\text{of } £1000 = £3,821.10$$

(c) To find the present value of the estimated rents of the re-lease; £2000 per annum for 21 years deferred 40 years at 10 per cent. and 3 per cent.

By rule 12; given above.

$$s = 10 \div 100 = 0.1$$

A_n = The amount of 1 per annum for 21 years at 3 per cent.; given in the tables as 28.67649

A_{n+d} = The amount of 1 per annum for (21+40) 61 years at 3 per cent.; given in the tables as 168.94504

The present value of the deferred annuity of 1

$$= \frac{28.67649}{1 + 0.1 \times 168.94504} = 1.60253$$

and the present value of the deferred annuity of £2000

$$= (2000 \times 1.60253) = £3205.06$$

The present value of (a) = 13,159.767

The present value of (b) = 3,821.10

The present value of (c) = 3,205.06

The present value of the estate = £20,185.927

Colliery Valuation.—(6) A colliery is estimated to yield a profit of £4000 a year for 10 years and to be worth £5000 at the end of the term. As the £5000 is not subject to the same risks as the profits, say a purchaser bargains for 5 per cent. on so much of the purchase money as is paid for the £5000 and 12 per cent. on the remaining portion which is paid for the estimated profits. The principal is to be redeemed at 3 per cent. Required the present value.

(a) To find the present value of an annuity of £4000 a year for 10 years at a remunerative rate of 12 per cent., the accumulative rate of the sinking fund being 3 per cent.

By rule 9.

$$\text{Present value of } 1 = \frac{1}{F_n + s}$$

In the example

$$s = 12 \div 100 = 0.12$$

and F_n = the annual sinking fund required to produce 1 in 10 years at 3 per cent.; given by the tables as . 087231

$$\text{Present value of } 1 = \frac{1}{.087231 + 0.12} = 4.82553$$

$$\begin{aligned} \text{Present value of the annuity of } \pounds 4000 \\ = 4000 \times 4.82553 = \pounds 19,302.12 \end{aligned}$$

(b) To find the present value of £5000 due 10 years hence allowing 5 per cent. interest on purchase money and 3 per cent. on the sinking fund.

By rule 6.

$$\text{Present value of } 1 = \frac{1}{1 + s \times A_n}$$

In the example

$$s = 5 \div 100 = .05$$

and A_n = the amount of 1 per annum for 10 years at 3 per cent.; given by the tables as 11.46388

$$\text{Present value of } 1 = \frac{1}{1 + .05 \times 11.46388} = .63565$$

$$\text{Present value of } \pounds 5000 = 5000 \times .63565 = \pounds 3,178.25$$

$$\text{Present value of the estimated profits} = \pounds 19,302.12$$

$$\text{Present value of colliery} = \pounds 22,480.37$$

(7) A colliery is estimated to yield profits of £2000 a year for 4 years and £4000 a year for 20 years thereafter. The increased profits at the end of 4 years are anticipated conditionally with an expenditure of £10,000 in development, at the rate of say £2250 a year during each year of the four years. After fulfilling all obligations at the end of the term it is estimated that there will remain £3000 from the proceeds of the sale of the plant. Required the present value, allowing a purchaser 12 per cent. on so much of his outlay as is to be paid for profits, and 5 per cent. on the remainder paid for the £3000 balance estimated as due at the end of the term. The redemption fund to be calculated as accumulating at 3 per cent.

In this problem it is premised that £10,000 has to be spent in development during the first 4 years. It is estimated that the colliery will yield profits to the amount of £2000 per annum during the same period, but these profits are problematic, and it would be incorrect to set them off against the expenditure necessary for development and assume that the purchaser will have to provide only £500 to make up the deficit. The £2000 per annum for the first 4 years must be valued at the remunerative rate stipulated in the conditions of the purchase, and the present value of the £2500 per annum for 4 years for development must be calculated at an accumulative rate of interest.

The value of the colliery is therefore arrived at as follows :—

(a) Present value of £2000 per annum for 4 years at 12 per cent. remunerative rate and 3 per cent. redemption.

(b) Present value of £4000 per annum for 20 years deferred 4 years at 12 per cent. remunerative rate and 3 per cent. redemption.

(c) Present value of £3000 due 24 years hence at 5 per cent. remunerative rate and 3 per cent. redemption.

Less (d) Present value of £2500 per annum for 4 years at 3 per cent.

(a) Present value of £2000 per annum for 4 years at 12 per cent. and 3 per cent.

By rule 9.

$$\text{Present value of annuity of } 1 = \frac{1}{F_n + s}$$

In the example

$$s = 12 \div 100 = 0.12$$

and F_n = The annual redemption fund which will produce 1 in 4 years at 3 per cent.; given by the tables as 239027

$$\begin{aligned} \text{Present value of annuity of } 1 &= \frac{1}{239027 + 0.12} \\ &= \frac{1}{359027} = 2.7853 \end{aligned}$$

$$\begin{aligned} \text{Present value of the annuity of } £2000 \\ &= 2000 \times 2.7853 = £5,570.6 \end{aligned}$$

(b) Present value of £4000 per annum for 20 years deferred 4 years at 12 per cent. and 3 per cent.

By rule 12.

$$\text{Present value of deferred annuity of } 1 = \frac{A_n}{1 + s \times A_{n+d}}$$

In the example

$$s = 12 \div 100 = 0.12$$

A_n = the amount of 1 per annum for 20 years at 3 per cent.; given by the tables as 26.87037

A_{n+d} = the amount of 1 per annum for (20 + 4) 24 years at 3 per cent.; given by the tables as 34.42647

Present value of deferred annuity of 1

$$= \frac{26.87037}{1 + 0.12 \times 34.42647} = \frac{26.87037}{5.1311764} = 5.2367$$

Present value of £4000 = $4000 \times 5.2367 = \text{£}20,946.8$

(c) Present value of £3000 due 24 years hence at 5 per cent. and 3 per cent.

By rule 6.

$$\text{Present value of 1} = \frac{1}{1 + s \times A_n}$$

In the example

$$s = 5 \div 100 = .05$$

and A_n = the amount of 1 per annum for 24 years at 3 per cent.; given by the tables as 34.42647

Present value of 1

$$= \frac{1}{1 + .05 \times 34.42647} = \frac{1}{2.7213235} = .3675$$

Present value of £3000 = $3000 \times .3675 = \text{£}1102.5$

(d) Present value of £2500 per annum for 4 years at 3 per cent.

The present value of 1 per annum for 4 years at 3 per cent. is given by the tables as 3.7171.

The present value of £2500 per annum = $2500 \times 3.7171 = \text{£}9292.75$.

Present value of (a) = 5,570.6

Present value of (b) = 20,946.8

Present value of (c) = 1,102.5

27,619.9

Present value of (d) = 9,292.75

Present value of colliery = £18,327.15

As has been previously pointed out on page 6, it may with reason be argued that the £3000 due at the end of the term should rank as recoverable capital, in which case its present value should be calculated at the same rate of interest as is allowed on the sinking fund.

INTEREST TABLES

TABLE I

AMOUNT AND PRESENT VALUE OF £1 AND OF £1 PER ANNUM

The amount of £1 in n years at rate $r = (1 + r)^n$ or R^n

The present value of £1 due n years hence at rate $r = \frac{1}{R^n}$ or V_n

The amount of £1 per annum in n years at rate r

$$= \frac{R^n - 1}{r} \text{ or } A_n$$

The present value of an annuity of £1 per annum for n years

$$\text{at rate } r = \frac{1 - V_n}{r} \text{ or } P_n$$

NOTE.—If interest be convertible at shorter periods than 1 year the amount of 1 may be found from the table giving the rate of interest for the specified period, the number of such periods in the term being substituted for years in the table.

Thus if the nominal rate of interest be 4 per cent. per annum and the interest is convertible half yearly for 10 years, the amount of 1 may be obtained from the table giving the amount of 1 in 20 years at 2 per cent.

If interest be convertible at shorter periods than 1 year the amount of 1 per annum may be found as follows. In the table giving the rate of interest for the specified period substitute the number of such periods in the term for years in the table, and divide the value given by the tables by the number of periods in one year.

Thus if the nominal rate of interest be 4 per cent. per annum and the interest is convertible half yearly for 10 years, the amount of 1 per annum is equivalent to one half the amount of 1 per annum for 20 years at two per cent.

1%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'01000	'99010	1'00000	0'99010	1
2	1'02010	'98030	2'01000	1'97040	2
3	1'03030	'97059	3'03010	2'94099	3
4	1'04060	'96098	4'06040	3'90197	4
5	1'05101	'95147	5'10101	4'85343	5
6	1'06152	'94205	6'15202	5'79548	6
7	1'07214	'93272	7'21354	6'72819	7
8	1'08286	'92348	8'28567	7'65168	8
9	1'09369	'91434	9'36853	8'56602	9
10	1'10462	'90529	10'46221	9'47130	10
11	1'11567	'89632	11'56683	10'36763	11
12	1'12683	'88745	12'68250	11'25508	12
13	1'13809	'87866	13'80933	12'13374	13
14	1'14947	'86996	14'94742	13'00370	14
15	1'16097	'86135	16'09690	13'86505	15
16	1'17258	'85282	17'25786	14'71787	16
17	1'18430	'84438	18'43044	15'56225	17
18	1'19615	'83602	19'61475	16'39827	18
19	1'20811	'82774	20'81089	17'22601	19
20	1'22019	'81954	22'01900	18'04555	20
21	1'23239	'81143	23'23919	18'85698	21
22	1'24472	'80340	24'47159	19'66038	22
23	1'25716	'79544	25'71630	20'45582	23
24	1'26973	'78757	26'97346	21'24339	24
25	1'28243	'77977	28'24320	22'02316	25
26	1'29526	'77205	29'52563	22'79520	26
27	1'30821	'76440	30'82089	23'55961	27
28	1'32129	'75684	32'12910	24'31644	28
29	1'33450	'74934	33'45039	25'06579	29
30	1'34785	'74192	34'78489	25'80771	30
31	1'36133	'73458	36'13274	26'54229	31
32	1'37494	'72730	37'49407	27'26959	32
33	1'38869	'72010	38'86901	27'98969	33
34	1'40258	'71297	40'25770	28'70267	34
35	1'41660	'70591	41'66028	29'40858	35
36	1'43077	'69892	43'07688	30'10750	36
37	1'44508	'69200	44'50765	30'79951	37
38	1'45953	'68515	45'95272	31'48466	38
39	1'47412	'67837	47'41225	32'16303	39
40	1'48886	'67165	48'88637	32'83469	40
41	1'50375	'66500	50'37524	33'49969	41
42	1'51879	'65842	51'87899	34'15811	42
43	1'53398	'65190	53'39778	34'81001	43
44	1'54932	'64545	54'93176	35'45545	44
45	1'56481	'63906	56'48107	36'09451	45
46	1'58046	'63273	58'04588	36'72724	46
47	1'59626	'62646	59'62634	37'35370	47
48	1'61223	'62026	61'22261	37'97396	48
49	1'62835	'61412	62'83483	38'58808	49
50	1'64463	'60804	64'46318	39'19612	50

INTEREST TABLES

1%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	1.66108	.60202	66.10781	39.79814	51
52	1.67769	.59606	67.76889	40.39419	52
53	1.69447	.59016	69.44658	40.98435	53
54	1.71141	.58431	71.14105	41.56866	54
55	1.72852	.57853	72.85246	42.14719	55
56	1.74581	.57280	74.58098	42.71999	56
57	1.76327	.56713	76.32679	43.28712	57
58	1.78090	.56151	78.09006	43.84863	58
59	1.79871	.55595	79.87096	44.40459	59
60	1.81670	.55045	81.66967	44.95504	60
61	1.83486	.54500	83.48637	45.50004	61
62	1.85321	.53960	85.32123	46.03964	62
63	1.87174	.53426	87.17444	46.57390	63
64	1.89046	.52897	89.04619	47.10287	64
65	1.90937	.52373	90.93665	47.62661	65
66	1.92846	.51855	92.84601	48.14516	66
67	1.94774	.51341	94.77447	48.65857	67
68	1.96722	.50833	96.72222	49.16690	68
69	1.98689	.50330	98.68944	49.67020	69
70	2.00676	.49831	100.67634	50.16851	70
71	2.02683	.49338	102.68310	50.66190	71
72	2.04710	.48850	104.70993	51.15039	72
73	2.06757	.48366	106.75703	51.63405	73
74	2.08825	.47887	108.82460	52.11292	74
75	2.10913	.47413	110.91285	52.58705	75
76	2.13022	.46944	113.02197	53.05649	76
77	2.15152	.46479	115.15219	53.52127	77
78	2.17304	.46019	117.30372	53.98146	78
79	2.19477	.45563	119.47675	54.43709	79
80	2.21672	.45112	121.67152	54.88821	80
81	2.23888	.44665	123.88824	55.33486	81
82	2.26127	.44223	126.12712	55.77709	82
83	2.28388	.43785	128.38839	56.21494	83
84	2.30672	.43352	130.67227	56.64845	84
85	2.32979	.42922	132.97900	57.07768	85
86	2.35309	.42497	135.30879	57.50265	86
87	2.37662	.42077	137.66187	57.92342	87
88	2.40038	.41660	140.03849	58.34002	88
89	2.42439	.41248	142.43888	58.75249	89
90	2.44863	.40839	144.86327	59.16088	90
91	2.47312	.40435	147.31190	59.56523	91
92	2.49785	.40034	149.78502	59.96557	92
93	2.52283	.39638	152.28287	60.36195	93
94	2.54806	.39246	154.80570	60.75441	94
95	2.57354	.38857	157.35375	61.14298	95
96	2.59927	.38472	159.92729	61.52770	96
97	2.62527	.38091	162.52656	61.90862	97
98	2.65152	.37714	165.15183	62.28576	98
99	2.67803	.37341	167.80335	62.65917	99
100	2.70481	.36971	170.48138	63.02888	100

1¹/₄%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'01250	'98765	1'00000	0'98765	1
2	1'02516	'97546	2'01250	1'96312	2
3	1'03797	'96342	3'03766	2'92653	3
4	1'05095	'95152	4'07563	3'87806	4
5	1'06408	'93978	5'12657	4'81783	5
6	1'07738	'92817	6'19065	5'74601	6
7	1'09085	'91672	7'26804	6'66273	7
8	1'10449	'90540	8'35889	7'56812	8
9	1'11829	'89422	9'46337	8'46234	9
10	1'13227	'88318	10'58167	9'34553	10
11	1'14642	'87228	11'71394	10'21780	11
12	1'16075	'86151	12'86036	11'07931	12
13	1'17526	'85087	14'02112	11'93018	13
14	1'18995	'84037	15'19638	12'77055	14
15	1'20483	'82999	16'38633	13'60055	15
16	1'21989	'81975	17'59116	14'42029	16
17	1'23514	'80963	18'81105	15'22992	17
18	1'25058	'79963	20'04619	16'02955	18
19	1'26621	'78976	21'29677	16'81931	19
20	1'28204	'78001	22'56298	17'59932	20
21	1'29806	'77038	23'84502	18'36969	21
22	1'31429	'76087	25'14308	19'13056	22
23	1'33072	'75147	26'45737	19'88204	23
24	1'34735	'74220	27'78808	20'62423	24
25	1'36419	'73303	29'13544	21'35727	25
26	1'38125	'72398	30'49963	22'08125	26
27	1'39851	'71505	31'88087	22'79630	27
28	1'41599	'70622	33'27938	23'50252	28
29	1'43369	'69750	34'69538	24'20002	29
30	1'45161	'68889	36'12907	24'88891	30
31	1'46976	'68038	37'58068	25'56929	31
32	1'48813	'67198	39'05044	26'24127	32
33	1'50673	'66369	40'53857	26'90496	33
34	1'52557	'65549	42'04530	27'56046	34
35	1'54464	'64740	43'57087	28'20786	35
36	1'56394	'63941	45'11551	28'84727	36
37	1'58349	'63152	46'67945	29'47878	37
38	1'60329	'62372	48'26294	30'10250	38
39	1'62333	'61602	49'86623	30'71852	39
40	1'64362	'60841	51'48956	31'32693	40
41	1'66416	'60090	53'13318	31'92784	41
42	1'68497	'59348	54'79734	32'52132	42
43	1'70603	'58616	56'48231	33'10748	43
44	1'72735	'57892	58'18834	33'68640	44
45	1'74895	'57177	59'91569	34'25817	45
46	1'77081	'56471	61'66464	34'82288	46
47	1'79294	'55774	63'43545	35'38062	47
48	1'81535	'55086	65'22839	35'93148	48
49	1'83805	'54406	67'04374	36'47554	49
50	1'86102	'53734	68'88179	37'01288	50

INTEREST TABLES

1 $\frac{1}{4}$ %

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	1·88429	·53071	70·74281	37·54358	51
52	1·90784	·52415	72·62710	38·06773	52
53	1·93169	·51768	74·53494	38·58542	53
54	1·95583	·51129	76·46662	39·09671	54
55	1·98028	·50498	78·42246	39·60169	55
56	2·00503	·49874	80·40274	40·10043	56
57	2·03010	·49259	82·40777	40·59302	57
58	2·05547	·48651	84·43787	41·07952	58
59	2·08117	·48050	86·49334	41·56002	59
60	2·10718	·47457	88·57451	42·03459	60
61	2·13352	·46871	90·68169	42·50330	61
62	2·16019	·46292	92·81521	42·96622	62
63	2·18719	·45721	94·97540	43·42343	63
64	2·21453	·45156	97·16259	43·87499	64
65	2·24221	·44599	99·37713	44·32098	65
66	2·27024	·44048	101·61934	44·76146	66
67	2·29862	·43504	103·88958	45·19651	67
68	2·32735	·42967	106·18820	45·62618	68
69	2·35644	·42437	108·51555	46·05055	69
70	2·38590	·41913	110·87200	46·46968	70
71	2·41572	·41395	113·25790	46·88363	71
72	2·44592	·40884	115·67362	47·29247	72
73	2·47649	·40380	118·11954	47·69627	73
74	2·50745	·39881	120·59604	48·09508	74
75	2·53879	·39389	123·10349	48·48897	75
76	2·57053	·38903	125·64228	48·87800	76
77	2·60266	·38422	128·21281	49·26222	77
78	2·63519	·37948	130·81547	49·64170	78
79	2·66813	·37479	133·45066	50·01649	79
80	2·70149	·37017	136·11880	50·38666	80
81	2·73525	·36560	138·82028	50·75225	81
82	2·76944	·36108	141·55554	51·11334	82
83	2·80406	·35663	144·32498	51·46996	83
84	2·83911	·35222	147·12904	51·82219	84
85	2·87460	·34787	149·96815	52·17006	85
86	2·91053	·34358	152·84276	52·51364	86
87	2·94692	·33934	155·75329	52·85298	87
88	2·98375	·33515	158·70021	53·18813	88
89	3·02105	·33101	161·68396	53·51914	89
90	3·05881	·32692	164·70501	53·84606	90
91	3·09705	·32289	167·76382	54·16895	91
92	3·13576	·31890	170·86087	54·48785	92
93	3·17496	·31496	173·99663	54·80282	93
94	3·21464	·31108	177·17159	55·11389	94
95	3·25483	·30724	180·38623	55·42113	95
96	3·29551	·30344	183·64106	55·72457	96
97	3·33671	·29970	186·93658	56·02427	97
98	3·37842	·29600	190·27328	56·32026	98
99	3·42065	·29234	193·65170	56·61261	99
100	3·46340	·28873	197·07234	56·90134	100

$1\frac{1}{2}\%$

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'01500	'98522	1'00000	0'98522	1
2	1'03023	'97066	2'01500	1'95588	2
3	1'04568	'95632	3'04523	2'91220	3
4	1'06136	'94218	4'09090	3'85438	4
5	1'07728	'92826	5'15227	4'78265	5
6	1'09344	'91454	6'22955	5'69719	6
7	1'10984	'90103	7'32299	6'59821	7
8	1'12649	'88771	8'43284	7'48593	8
9	1'14339	'87459	9'55933	8'36052	9
10	1'16054	'86167	10'70272	9'22219	10
11	1'17795	'84893	11'86326	10'07112	11
12	1'19562	'83639	13'04121	10'90751	12
13	1'21355	'82403	14'23683	11'73153	13
14	1'23176	'81185	15'45038	12'54338	14
15	1'25023	'79985	16'68214	13'34323	15
16	1'26899	'78803	17'93237	14'13126	16
17	1'28802	'77639	19'20136	14'90765	17
18	1'30734	'76491	20'48938	15'67256	18
19	1'32695	'75361	21'79672	16'42617	19
20	1'34686	'74247	23'12367	17'16864	20
21	1'36706	'73150	24'47052	17'90014	21
22	1'38756	'72069	25'83758	18'62083	22
23	1'40838	'71004	27'22515	19'33086	23
24	1'42950	'69954	28'63352	20'03041	24
25	1'45095	'68921	30'06302	20'71961	25
26	1'47271	'67902	31'51397	21'39863	26
27	1'49480	'66899	32'98668	22'06762	27
28	1'51722	'65910	34'48148	22'72672	28
29	1'53998	'64936	35'99870	23'37608	29
30	1'56308	'63976	37'53868	24'01584	30
31	1'58653	'63031	39'10176	24'64615	31
32	1'61032	'62099	40'68829	25'26714	32
33	1'63448	'61182	42'29862	25'87896	33
34	1'65900	'60277	43'93309	26'48173	34
35	1'68388	'59387	45'59209	27'07560	35
36	1'70914	'58509	47'27597	27'66068	36
37	1'73478	'57644	48'98511	28'23713	37
38	1'76080	'56792	50'71989	28'80505	38
39	1'78721	'55953	52'48068	29'36458	39
40	1'81402	'55126	54'26789	29'91585	40
41	1'84123	'54312	56'08191	30'45896	41
42	1'86885	'53509	57'92314	30'99405	42
43	1'89688	'52718	59'79199	31'52123	43
44	1'92533	'51939	61'68887	32'04062	44
45	1'95421	'51171	63'61420	32'55234	45
46	1'98353	'50415	65'56841	33'05649	46
47	2'01328	'49670	67'55194	33'55319	47
48	2'04348	'48936	69'56522	34'04255	48
49	2'07413	'48213	71'60870	34'52468	49
50	2'10524	'47500	73'68283	34'99969	50

INTEREST TABLES

1½%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	2·13682	·46798	75·78807	35·46767	51
52	2·16887	·46107	77·92489	35·92874	52
53	2·20141	·45426	80·09376	36·38300	53
54	2·23443	·44754	82·29517	36·83054	54
55	2·26794	·44093	84·52962	37·27147	55
56	2·30196	·43441	86·79754	37·70588	56
57	2·33649	·42799	89·09951	38·13387	57
58	2·37154	·42167	91·43600	38·55554	58
59	2·40711	·41544	93·80754	38·97097	59
60	2·44322	·40930	96·21465	39·38027	60
61	2·47987	·40325	98·65787	39·78352	61
62	2·51707	·39729	101·13774	40·18080	62
63	2·55482	·39142	103·65481	40·57222	63
64	2·59314	·38563	106·20963	40·95785	64
65	2·63204	·37993	108·80277	41·33779	65
66	2·67152	·37432	111·43481	41·71211	66
67	2·71160	·36879	114·10634	42·08089	67
68	2·75227	·36334	116·81793	42·44423	68
69	2·79355	·35797	119·57020	42·80220	69
70	2·83546	·35268	122·36375	43·15487	70
71	2·87799	·34746	125·19921	43·50234	71
72	2·92116	·34233	128·07720	43·84467	72
73	2·96498	·33727	130·99836	44·18194	73
74	3·00945	·33229	133·96333	44·51422	74
75	3·05459	·32738	136·97278	44·84160	75
76	3·10041	·32254	140·02737	45·16414	76
77	3·14692	·31777	143·12778	45·48191	77
78	3·19412	·31308	146·27470	45·79499	78
79	3·24203	·30845	149·46882	46·10343	79
80	3·29066	·30389	152·71085	46·40732	80
81	3·34002	·29940	156·00152	46·70672	81
82	3·39012	·29497	159·34154	47·00170	82
83	3·44097	·29062	162·73166	47·29231	83
84	3·49259	·28632	166·17264	47·57863	84
85	3·54498	·28209	169·66523	47·86072	85
86	3·59815	·27792	173·21020	48·13864	86
87	3·65213	·27381	176·80836	48·41246	87
88	3·70691	·26977	180·46048	48·68222	88
89	3·76251	·26578	184·16739	48·94800	89
90	3·81895	·26185	187·92990	49·20985	90
91	3·87623	·25798	191·74885	49·46784	91
92	3·93438	·25417	195·62508	49·72201	92
93	3·99339	·25041	199·55946	49·97242	93
94	4·05329	·24671	203·55285	50·21913	94
95	4·11409	·24307	207·60614	50·46220	95
96	4·17580	·23947	211·72023	50·70168	96
97	4·23844	·23594	215·89604	50·93761	97
98	4·30202	·23245	220·13448	51·17006	98
99	4·36655	·22901	224·43650	51·39907	99
100	4·43205	·22563	228·80304	51·62470	100

1³/₄%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'01750	'98280	1'00000	0'98280	1
2	1'03531	'96590	2'01750	1'94870	2
3	1'05342	'94929	3'05281	2'89798	3
4	1'07186	'93296	4'10623	3'83094	4
5	1'09062	'91691	5'17809	4'74786	5
6	1'10970	'90114	6'26871	5'64900	6
7	1'12912	'88564	7'37841	6'53464	7
8	1'14888	'87041	8'50753	7'40505	8
9	1'16899	'85544	9'65641	8'26049	9
10	1'18944	'84073	10'82540	9'10122	10
11	1'21026	'82627	12'01484	9'92749	11
12	1'23144	'81206	13'22510	10'73955	12
13	1'25299	'79809	14'45654	11'53764	13
14	1'27492	'78436	15'70953	12'32201	14
15	1'29723	'77087	16'98445	13'09288	15
16	1'31993	'75762	18'28168	13'85050	16
17	1'34303	'74459	19'60161	14'59508	17
18	1'36653	'73178	20'94463	15'32686	18
19	1'39045	'71919	22'31117	16'04606	19
20	1'41478	'70682	23'70161	16'75288	20
21	1'43954	'69467	25'11639	17'44755	21
22	1'46473	'68272	26'55593	18'13027	22
23	1'49036	'67098	28'02065	18'80125	23
24	1'51644	'65944	29'51102	19'46069	24
25	1'54298	'64810	31'02746	20'10878	25
26	1'56998	'63695	32'57044	20'74573	26
27	1'59746	'62599	34'14042	21'37173	27
28	1'62541	'61523	35'73788	21'98695	28
29	1'65386	'60465	37'36329	22'59160	29
30	1'68280	'59425	39'01715	23'18585	30
31	1'71225	'58403	40'69995	23'76988	31
32	1'74221	'57398	42'41220	24'34386	32
33	1'77270	'56411	44'15441	24'90797	33
34	1'80372	'55441	45'92712	25'46238	34
35	1'83529	'54487	47'73084	26'00725	35
36	1'86741	'53550	49'56613	26'54275	36
37	1'90009	'52629	51'43354	27'06904	37
38	1'93334	'51724	53'33362	27'58628	38
39	1'96717	'50834	55'26696	28'09463	39
40	2'00160	'49960	57'23413	28'59423	40
41	2'03663	'49101	59'23573	29'08524	41
42	2'07227	'48256	61'27236	29'56780	42
43	2'10853	'47426	63'34462	30'04207	43
44	2'14543	'46611	65'45315	30'50817	44
45	2'18298	'45809	67'59858	30'96626	45
46	2'22118	'45021	69'78156	31'41647	46
47	2'26005	'44247	72'00274	31'85894	47
48	2'29960	'43486	74'26278	32'29380	48
49	2'33984	'42738	76'56238	32'72118	49
50	2'38079	'42003	78'90222	33'14121	50

INTEREST TABLES

1³/₄%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	2'42245	41280	81'28301	33'55401	51
52	2'46485	40570	83'70547	33'95972	52
53	2'50798	39873	86'17031	34'35845	53
54	2'55187	39187	88'67829	34'75032	54
55	2'59653	38513	91'23016	35'13545	55
56	2'64197	37851	93'82669	35'51395	56
57	2'68820	37200	96'46866	35'88595	57
58	2'73524	36560	99'15686	36'25155	58
59	2'78311	35931	101'89210	36'61086	59
60	2'83182	35313	104'67522	36'96399	60
61	2'88137	34706	107'50703	37'31104	61
62	2'93180	34109	110'38841	37'65213	62
63	2'98310	33522	113'32020	37'98735	63
64	3'03531	32946	116'30331	38'31681	64
65	3'08843	32379	119'33861	38'64060	65
66	3'14247	31822	122'42704	38'95882	66
67	3'19747	31275	125'56951	39'27157	67
68	3'25342	30737	128'76698	39'57893	68
69	3'31036	30208	132'02040	39'88102	69
70	3'36829	29689	135'33076	40'17790	70
71	3'42723	29178	138'69905	40'46968	71
72	3'48721	28676	142'12628	40'75645	72
73	3'54824	28183	145'61349	41'03828	73
74	3'61033	27698	149'16173	41'31526	74
75	3'67351	27222	152'77206	41'58748	75
76	3'73780	26754	156'44557	41'85502	76
77	3'80321	26294	160'18336	42'11795	77
78	3'86977	25841	163'98657	42'37636	78
79	3'93749	25397	167'85634	42'63033	79
80	4'00639	24960	171'79382	42'87994	80
81	4'07650	24531	175'80022	43'12524	81
82	4'14784	24109	179'87672	43'36633	82
83	4'22043	23694	184'02456	43'60328	83
84	4'29429	23287	188'24499	43'83614	84
85	4'36944	22886	192'53928	44'06501	85
86	4'44590	22493	196'90872	44'28993	86
87	4'52371	22106	201'35462	44'51099	87
88	4'60287	21726	205'87833	44'72824	88
89	4'68342	21352	210'48120	44'94176	89
90	4'76538	20985	215'16462	45'15161	90
91	4'84877	20624	219'93000	45'35785	91
92	4'93363	20269	224'77877	45'56054	92
93	5'01997	19920	229'71240	45'75974	93
94	5'10782	19578	234'73237	45'95552	94
95	5'19720	19241	239'84018	46'14793	95
96	5'28815	18910	245'03739	46'33704	96
97	5'38070	18585	250'32554	46'52288	97
98	5'47486	18265	255'70624	46'70554	98
99	5'57067	17951	261'18110	46'88505	99
100	5'66816	17642	266'75177	47'06147	100

2%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1·02000	·98039	1·00000	·98039	1
2	1·04040	·96117	2·02000	1·94156	2
3	1·06121	·94232	3·06040	2·88388	3
4	1·08243	·92385	4·12161	3·80773	4
5	1·10408	·90573	5·20404	4·71346	5
6	1·12616	·88797	6·30812	5·60143	6
7	1·14869	·87056	7·43428	6·47199	7
8	1·17166	·85349	8·58297	7·32548	8
9	1·19509	·83676	9·75463	8·16224	9
10	1·21899	·82035	10·94972	8·98258	10
11	1·24337	·80426	12·16872	9·78685	11
12	1·26824	·78849	13·41209	10·57534	12
13	1·29361	·77303	14·68033	11·34837	13
14	1·31948	·75788	15·97394	12·10625	14
15	1·34587	·74301	17·29342	12·84926	15
16	1·37279	·72845	18·63928	13·57771	16
17	1·40024	·71416	20·01207	14·29187	17
18	1·42825	·70016	21·41231	14·99203	18
19	1·45681	·68643	22·84056	15·67846	19
20	1·48595	·67297	24·29737	16·35143	20
21	1·51567	·65978	25·78332	17·01121	21
22	1·54598	·64684	27·29898	17·65805	22
23	1·57690	·63416	28·84496	18·29220	23
24	1·60844	·62172	30·42186	18·91393	24
25	1·64061	·60953	32·03030	19·52346	25
26	1·67342	·59758	33·67090	20·12104	26
27	1·70689	·58586	35·34432	20·70690	27
28	1·74102	·57437	37·05121	21·28127	28
29	1·77584	·56311	38·79223	21·84438	29
30	1·81136	·55207	40·56808	22·39646	30
31	1·84759	·54125	42·37944	22·93770	31
32	1·88454	·53063	44·22703	23·46833	32
33	1·92223	·52023	46·11157	23·98856	33
34	1·96068	·51003	48·03380	24·49859	34
35	1·99989	·50003	49·99447	24·99862	35
36	2·03989	·49022	51·99436	25·48884	36
37	2·08061	·48061	54·03425	25·96945	37
38	2·12230	·47119	56·11494	26·44064	38
39	2·16474	·46195	58·23723	26·90259	39
40	2·20803	·45289	60·40198	27·35548	40
41	2·25220	·44401	62·61002	27·79949	41
42	2·29724	·43530	64·86222	28·23479	42
43	2·34319	·42677	67·15947	28·66156	43
44	2·39005	·41840	69·50265	29·07996	44
45	2·43785	·41020	71·89271	29·49016	45
46	2·48661	·40215	74·33056	29·89231	46
47	2·53634	·39427	76·81717	30·28658	47
48	2·58707	·38654	79·35352	30·67312	48
49	2·63881	·37896	81·94059	31·05208	49
50	2·69159	·37153	84·57940	31·42361	50

INTEREST TABLES

2%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	2.74542	.36424	87.27098	31.78785	51
52	2.80033	.35710	90.01640	32.14495	52
53	2.85633	.35010	92.81673	32.49505	53
54	2.91346	.34323	95.67307	32.83828	54
55	2.97173	.33650	98.58653	33.17479	55
56	3.03117	.32991	101.55826	33.50469	56
57	3.09179	.32344	104.58943	33.82813	57
58	3.15362	.31710	107.68121	34.14523	58
59	3.21670	.31088	110.83484	34.45610	59
60	3.28103	.30478	114.05154	34.76089	60
61	3.34665	.29881	117.33257	35.05969	61
62	3.41358	.29295	120.67922	35.35264	62
63	3.48186	.28720	124.09280	35.63984	63
64	3.55149	.28157	127.57466	35.92141	64
65	3.62252	.27605	131.12615	36.19746	65
66	3.69497	.27064	134.74868	36.46810	66
67	3.76887	.26533	138.44365	36.73343	67
68	3.84425	.26013	142.21252	36.99356	68
69	3.92114	.25503	146.05677	37.24859	69
70	3.99956	.25003	149.97791	37.49862	70
71	4.07955	.24513	153.97747	37.74374	71
72	4.16114	.24032	158.05702	37.98406	72
73	4.24436	.23561	162.21816	38.21967	73
74	4.32925	.23099	166.46252	38.45066	74
75	4.41584	.22646	170.79177	38.67711	75
76	4.50415	.22202	175.20761	38.89913	76
77	4.59424	.21766	179.71176	39.11679	77
78	4.68612	.21340	184.30599	39.33019	78
79	4.77984	.20921	188.99211	39.53940	79
80	4.87544	.20511	193.77195	39.74451	80
81	4.97295	.20109	198.64739	39.94560	81
82	5.07241	.19715	203.62034	40.14275	82
83	5.17385	.19328	208.69275	40.33603	83
84	5.27733	.18949	213.86660	40.52551	84
85	5.38288	.18577	219.14394	40.71129	85
86	5.49054	.18213	224.52681	40.89342	86
87	5.60035	.17856	230.01735	41.07198	87
88	5.71235	.17506	235.61770	41.24704	88
89	5.82660	.17163	241.33005	41.41867	89
90	5.94313	.16826	247.15665	41.58693	90
91	6.06200	.16496	253.09979	41.75189	91
92	6.18324	.16173	259.16178	41.91362	92
93	6.30690	.15856	265.34502	42.07217	93
94	6.43304	.15545	271.65192	42.22762	94
95	6.56170	.15240	278.08496	42.38002	95
96	6.69293	.14941	284.64666	42.52943	96
97	6.82679	.14648	291.33959	42.67591	97
98	6.96333	.14361	298.16638	42.81952	98
99	7.10259	.14079	305.12971	42.96032	99
100	7.24465	.13803	312.23230	43.09835	100

2 $\frac{1}{4}$ %

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1·02250	·97800	1·00000	0·97800	1
2	1·04551	·95647	2·02250	1·93447	2
3	1·06903	·93543	3·06801	2·86990	3
4	1·09308	·91484	4·13704	3·78474	4
5	1·11768	·89471	5·23012	4·67945	5
6	1·14283	·87502	6·34780	5·55448	6
7	1·16854	·85577	7·49062	6·41025	7
8	1·19483	·83694	8·65916	7·24718	8
9	1·22171	·81852	9·85399	8·06571	9
10	1·24920	·80051	11·07571	8·86622	10
11	1·27731	·78290	12·32491	9·64911	11
12	1·30605	·76567	13·60222	10·41478	12
13	1·33544	·74882	14·90827	11·16360	13
14	1·36548	·73234	16·24371	11·89594	14
15	1·39621	·71623	17·60919	12·61217	15
16	1·42762	·70047	19·00540	13·31263	16
17	1·45974	·68505	20·43302	13·99768	17
18	1·49259	·66998	21·89276	14·66766	18
19	1·52617	·65523	23·38535	15·32290	19
20	1·56051	·64082	24·91152	15·96371	20
21	1·59562	·62672	26·47203	16·59043	21
22	1·63152	·61292	28·06765	17·20335	22
23	1·66823	·59944	29·69917	17·80279	23
24	1·70577	·58625	31·36740	18·38904	24
25	1·74415	·57335	33·07317	18·96238	25
26	1·78339	·56073	34·81732	19·52311	26
27	1·82352	·54839	36·60071	20·07150	27
28	1·86454	·53632	38·42422	20·60783	28
29	1·90650	·52452	40·28877	21·13235	29
30	1·94939	·51298	42·19526	21·64533	30
31	1·99325	·50169	44·14466	22·14702	31
32	2·03810	·49065	46·13791	22·63767	32
33	2·08396	·47986	48·17602	23·11753	33
34	2·13085	·46930	50·25998	23·58683	34
35	2·17879	·45897	52·39083	24·04580	35
36	2·22782	·44887	54·56962	24·49467	36
37	2·27794	·43899	56·79744	24·93366	37
38	2·32920	·42933	59·07539	25·36299	38
39	2·38160	·41989	61·40457	25·78288	39
40	2·43519	·41065	63·78618	26·19352	40
41	2·48998	·40161	66·22137	26·59513	41
42	2·54601	·39277	68·71135	26·98790	42
43	2·60329	·38413	71·25735	27·37203	43
44	2·66186	·37568	73·86064	27·74771	44
45	2·72176	·36741	76·52251	28·11512	45
46	2·78300	·35932	79·24426	28·47444	46
47	2·84561	·35142	82·02726	28·82586	47
48	2·90964	·34369	84·87287	29·16955	48
49	2·97511	·33612	87·78251	29·50567	49
50	3·04205	·32873	90·75762	29·83440	50

INTEREST TABLES

2¹/₄%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	3·11049	·32149	93·79966	30·15589	51
52	3·18048	·31442	96·91016	30·47031	52
53	3·25204	·30750	100·09064	30·77781	53
54	3·32521	·30073	103·34267	31·07854	54
55	3·40003	·29412	106·66788	31·37265	55
56	3·47653	·28764	110·06791	31·66030	56
57	3·55475	·28131	113·54444	31·94161	57
58	3·63473	·27512	117·09919	32·21673	58
59	3·71651	·26907	120·73392	32·48580	59
60	3·80013	·26315	124·45043	32·74895	60
61	3·88564	·25736	128·25057	33·00631	61
62	3·97306	·25169	132·13621	33·25800	62
63	4·06246	·24616	136·10927	33·50416	63
64	4·15386	·24074	140·17173	33·74490	64
65	4·24733	·23544	144·32559	33·98034	65
66	4·34289	·23026	148·57292	34·21060	66
67	4·44061	·22519	152·91581	34·43580	67
68	4·54052	·22024	157·35642	34·65604	68
69	4·64268	·21539	161·89694	34·87143	69
70	4·74714	·21065	166·53962	35·08208	70
71	4·85395	·20602	171·28676	35·28810	71
72	4·96317	·20148	176·14071	35·48959	72
73	5·07484	·19705	181·10388	35·68664	73
74	5·18902	·19271	186·17871	35·87935	74
75	5·30577	·18847	191·36774	36·06783	75
76	5·42515	·18433	196·67351	36·25215	76
77	5·54722	·18027	202·09866	36·43242	77
78	5·67203	·17630	207·64588	36·60873	78
79	5·79965	·17242	213·31792	36·78115	79
80	5·93015	·16863	219·11757	36·94978	80
81	6·06357	·16492	225·04771	37·11470	81
82	6·20000	·16129	231·11129	37·27599	82
83	6·33950	·15774	237·31129	37·43373	83
84	6·48214	·15427	243·65080	37·58800	84
85	6·62799	·15088	250·13294	37·73888	85
86	6·77712	·14756	256·76093	37·88643	86
87	6·92961	·14431	263·53805	38·03074	87
88	7·08552	·14113	270·46766	38·17187	88
89	7·24495	·13803	277·55318	38·30990	89
90	7·40796	·13499	284·79813	38·44489	90
91	7·57464	·13202	292·20608	38·57691	91
92	7·74507	·12911	299·78072	38·70602	92
93	7·91933	·12627	307·52579	38·83230	93
94	8·09752	·12349	315·44512	38·95579	94
95	8·27971	·12078	323·54263	39·07657	95
96	8·46600	·11812	331·82234	39·19469	96
97	8·65649	·11552	340·28834	39·31021	97
98	8·85126	·11298	348·94483	39·42319	98
99	9·05041	·11049	357·79609	39·53368	99
100	9·25405	·10806	366·84650	39·64174	100

$2\frac{1}{2}\%$

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1·02500	·97561	1·00000	·97561	1
2	1·05062	·95181	2·02500	1·92742	2
3	1·07689	·92860	3·07562	2·85602	3
4	1·10381	·90595	4·15252	3·76197	4
5	1·13141	·88385	5·25633	4·64583	5
6	1·15969	·86230	6·38774	5·50812	6
7	1·18869	·84127	7·54743	6·34939	7
8	1·21840	·82075	8·73612	7·17014	8
9	1·24886	·80073	9·95452	7·97087	9
10	1·28008	·78120	11·20338	8·75206	10
11	1·31209	·76214	12·48347	9·51421	11
12	1·34489	·74356	13·79555	10·25776	12
13	1·37851	·72542	15·14044	10·98318	13
14	1·41297	·70773	16·51895	11·69091	14
15	1·44830	·69047	17·93193	12·38138	15
16	1·48451	·67363	19·38022	13·05500	16
17	1·52162	·65720	20·86473	13·71220	17
18	1·55966	·64117	22·38635	14·35336	18
19	1·59865	·62553	23·94601	14·97889	19
20	1·63862	·61027	25·54466	15·58916	20
21	1·67958	·59539	27·18327	16·18455	21
22	1·72157	·58086	28·86286	16·76541	22
23	1·76461	·56670	30·58443	17·33211	23
24	1·80873	·55288	32·34904	17·88499	24
25	1·85394	·53939	34·15776	18·42438	25
26	1·90029	·52623	36·01171	18·95061	26
27	1·94780	·51340	37·91200	19·46401	27
28	1·99650	·50088	39·85980	19·96489	28
29	2·04640	·48866	41·85630	20·45355	29
30	2·09757	·47674	43·90270	20·93029	30
31	2·15000	·46511	46·00027	21·39540	31
32	2·20376	·45377	48·15028	21·84918	32
33	2·25885	·44270	50·35403	22·29188	33
34	2·31532	·43191	52·61289	22·72379	34
35	2·37321	·42137	54·92821	23·14516	35
36	2·43254	·41109	57·30141	23·55625	36
37	2·49335	·40107	59·73395	23·95732	37
38	2·55568	·39128	62·22730	24·34860	38
39	2·61957	·38174	64·78298	24·73034	39
40	2·68506	·37243	67·40256	25·10277	40
41	2·75219	·36335	70·08762	25·46612	41
42	2·82100	·35448	72·83981	25·82061	42
43	2·89152	·34584	75·66081	26·16645	43
44	2·96381	·33740	78·55232	26·50385	44
45	3·03790	·32917	81·51613	26·83302	45
46	3·11385	·32115	84·55403	27·15417	46
47	3·19169	·31331	87·66788	27·46748	47
48	3·27149	·30567	90·85958	27·77315	48
49	3·35328	·29822	94·13107	28·07137	49
50	3·43711	·29094	97·48435	28·36231	50

INTEREST TABLES

2¹⁰/₂%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	3.52304	.28385	100.92146	28.64616	51
52	3.61111	.27692	104.44449	28.92308	52
53	3.70139	.27017	108.05561	29.19325	53
54	3.79392	.26358	111.75700	29.45683	54
55	3.88877	.25715	115.55092	29.71398	55
56	3.98599	.25088	119.43969	29.96486	56
57	4.08564	.24476	123.42569	30.20962	57
58	4.18778	.23879	127.51133	30.44841	58
59	4.29248	.23296	131.69911	30.68137	59
60	4.39979	.22728	135.99159	30.90866	60
61	4.50978	.22174	140.39138	31.13040	61
62	4.62253	.21633	144.90116	31.34673	62
63	4.73809	.21106	149.52369	31.55778	63
64	4.85654	.20591	154.26179	31.76369	64
65	4.97796	.20089	159.11833	31.96458	65
66	5.10241	.19599	164.09629	32.16056	66
67	5.22997	.19121	169.19869	32.35177	67
68	5.36072	.18654	174.42866	32.53831	68
69	5.49473	.18199	179.78938	32.72030	69
70	5.63210	.17755	185.28411	32.89786	70
71	5.77291	.17322	190.91622	33.07108	71
72	5.91723	.16900	196.68912	33.24008	72
73	6.06516	.16488	202.60635	33.40495	73
74	6.21679	.16085	208.67151	33.56581	74
75	6.37221	.15693	214.88829	33.72274	75
76	6.53151	.15310	221.26050	33.87584	76
77	6.69480	.14937	227.79201	34.02521	77
78	6.86217	.14573	234.48681	34.17094	78
79	7.03372	.14217	241.34898	34.31311	79
80	7.20957	.13870	248.38271	34.45182	80
81	7.38981	.13532	255.59228	34.58714	81
82	7.57455	.13202	262.98209	34.71916	82
83	7.76392	.12880	270.55664	34.84796	83
84	7.95801	.12566	278.32056	34.97362	84
85	8.15696	.12259	286.27857	35.09621	85
86	8.36089	.11960	294.43553	35.21582	86
87	8.56991	.11669	302.79642	35.33251	87
88	8.78416	.11384	311.36633	35.44635	88
89	9.00376	.11106	320.15049	35.55741	89
90	9.22886	.10836	329.15425	35.66577	90
91	9.45958	.10571	338.38311	35.77148	91
92	9.69607	.10313	347.84269	35.87462	92
93	9.93847	.10062	357.53875	35.97523	93
94	10.18693	.09817	367.47722	36.07340	94
95	10.44160	.09577	377.66415	36.16917	95
96	10.70264	.09343	388.10576	36.26261	96
97	10.97021	.09116	398.80840	36.35376	97
98	11.24447	.08893	409.77861	36.44269	98
99	11.52558	.08676	421.02308	36.52946	99
100	11.81372	.08465	432.54865	36.61410	100

2³/₄%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1·02750	·97324	1·00000	0·97324	1
2	1·05576	·94719	2·02750	1·92042	2
3	1·08479	·92184	3·08326	2·84226	3
4	1·11462	·89717	4·16805	3·73943	4
5	1·14527	·87315	5·28267	4·61258	5
6	1·17677	·84978	6·42794	5·46237	6
7	1·20913	·82704	7·60471	6·28941	7
8	1·24238	·80491	8·81384	7·09431	8
9	1·27655	·78336	10·05622	7·87768	9
10	1·31165	·76240	11·33276	8·64008	10
11	1·34772	·74199	12·64442	9·38207	11
12	1·38478	·72213	13·99214	10·10420	12
13	1·42287	·70281	15·37692	10·80701	13
14	1·46199	·68400	16·79979	11·49101	14
15	1·50220	·66569	18·26178	12·15670	15
16	1·54351	·64787	19·76398	12·80457	16
17	1·58596	·63053	21·30749	13·43511	17
18	1·62957	·61366	22·89344	14·04877	18
19	1·67438	·59723	24·52301	14·64600	19
20	1·72043	·58125	26·19740	15·22725	20
21	1·76774	·56569	27·91783	15·79295	21
22	1·81635	·55055	29·68557	16·34350	22
23	1·86630	·53582	31·50192	16·87932	23
24	1·91763	·52148	33·36822	17·40080	24
25	1·97036	·50752	35·28585	17·90832	25
26	2·02455	·49394	37·25621	18·40226	26
27	2·08022	·48072	39·28075	18·88297	27
28	2·13743	·46785	41·36098	19·35083	28
29	2·19621	·45533	43·49840	19·80616	29
30	2·25660	·44314	45·69461	20·24930	30
31	2·31866	·43128	47·95121	20·68059	31
32	2·38242	·41974	50·26987	21·10033	32
33	2·44794	·40851	52·65229	21·50883	33
34	2·51526	·39757	55·10023	21·90641	34
35	2·58443	·38693	57·61548	22·29334	35
36	2·65550	·37658	60·19991	22·66992	36
37	2·72852	·36650	62·85541	23·03642	37
38	2·80356	·35669	65·58393	23·39311	38
39	2·88066	·34714	68·38749	23·74025	39
40	2·95987	·33785	71·26815	24·07810	40
41	3·04127	·32881	74·22802	24·40691	41
42	3·12491	·32001	77·26929	24·72692	42
43	3·21084	·31144	80·39419	25·03837	43
44	3·29914	·30311	83·60504	25·34147	44
45	3·38986	·29500	86·90417	25·63647	45
46	3·48309	·28710	90·29404	25·92357	46
47	3·57887	·27942	93·77712	26·20299	47
48	3·67729	·27194	97·35600	26·47493	48
49	3·77842	·26466	101·03329	26·73959	49
50	3·88232	·25758	104·81170	26·99717	50

INTEREST TABLES

2³/₄%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	3·98909	·25068	108·69402	27·24785	51
52	4·09879	·24397	112·68311	27·49183	52
53	4·21150	·23744	116·78189	27·72927	53
54	4·32732	·23109	120·99340	27·96036	54
55	4·44632	·22491	125·32071	28·18527	55
56	4·56859	·21889	129·76703	28·40415	56
57	4·69423	·21303	134·33563	28·61718	57
58	4·82332	·20733	139·02986	28·82451	58
59	4·95596	·20178	143·85318	29·02628	59
60	5·09225	·19638	148·80914	29·22266	60
61	5·23229	·19112	153·90139	29·41378	61
62	5·37618	·18601	159·13368	29·59979	62
63	5·52402	·18103	164·50986	29·78082	63
64	5·67593	·17618	170·03388	29·95700	64
65	5·83202	·17147	175·70981	30·12846	65
66	5·99240	·16688	181·54183	30·29534	66
67	6·15719	·16241	187·53423	30·45775	67
68	6·32651	·15806	193·69142	30·61582	68
69	6·50049	·15383	200·01793	30·76965	69
70	6·67926	·14972	206·51843	30·91937	70
71	6·86294	·14571	213·19768	31·06508	71
72	7·05167	·14181	220·06062	31·20689	72
73	7·24559	·13802	227·11229	31·34491	73
74	7·44484	·13432	234·35788	31·47923	74
75	7·64957	·13073	241·80272	31·60995	75
76	7·85994	·12723	249·45229	31·73718	76
77	8·07609	·12382	257·31223	31·86100	77
78	8·29818	·12051	265·38832	31·98151	78
79	8·52638	·11728	273·68649	32·09880	79
80	8·76085	·11414	282·21287	32·21294	80
81	9·00178	·11109	290·97373	32·32403	81
82	9·24933	·10812	299·97551	32·43214	82
83	9·50368	·10522	309·22483	32·53737	83
84	9·76503	·10241	318·72851	32·63977	84
85	10·03357	·09967	328·49355	32·73944	85
86	10·30950	·09700	338·52712	32·83644	86
87	10·59301	·09440	348·83662	32·93084	87
88	10·88431	·09188	359·42962	33·02271	88
89	11·18363	·08942	370·31394	33·11213	89
90	11·49118	·08702	381·49757	33·19915	90
91	11·80719	·08469	392·98876	33·28385	91
92	12·13189	·08243	404·79595	33·36628	92
93	12·46552	·08022	416·92783	33·44650	93
94	12·80832	·07807	429·39335	33·52457	94
95	13·16055	·07598	442·20167	33·60056	95
96	13·52246	·07395	455·36221	33·67451	96
97	13·89433	·07197	468·88467	33·74648	97
98	14·27642	·07005	482·77900	33·81652	98
99	14·66902	·06817	497·05542	33·88469	99
100	15·07242	·06635	511·72445	33·95104	100

3%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1·03000	·97087	1·00000	·97087	1
2	1·06090	·94260	2·03000	1·91347	2
3	1·09273	·91514	3·09090	2·82861	3
4	1·12551	·88849	4·18363	3·71710	4
5	1·15927	·86261	5·30914	4·57971	5
6	1·19405	·83748	6·46841	5·41719	6
7	1·22987	·81309	7·66246	6·23028	7
8	1·26677	·78941	8·89234	7·01969	8
9	1·30477	·76642	10·15911	7·78611	9
10	1·34392	·74409	11·46388	8·53020	10
11	1·38423	·72242	12·80780	9·25262	11
12	1·42576	·70138	14·19203	9·95400	12
13	1·46853	·68095	15·61779	10·63496	13
14	1·51259	·66112	17·08632	11·29607	14
15	1·55797	·64186	18·59891	11·93794	15
16	1·60471	·62317	20·15688	12·56110	16
17	1·65285	·60502	21·76159	13·16612	17
18	1·70243	·58739	23·41444	13·75351	18
19	1·75351	·57029	25·11687	14·32380	19
20	1·80611	·55368	26·87037	14·87748	20
21	1·86029	·53755	28·67649	15·41502	21
22	1·91610	·52189	30·53678	15·93692	22
23	1·97359	·50669	32·45288	16·44361	23
24	2·03279	·49193	34·42647	16·93554	24
25	2·09378	·47761	36·45926	17·41315	25
26	2·15659	·46369	38·55304	17·87684	26
27	2·22129	·45019	40·70963	18·32703	27
28	2·28793	·43708	42·93092	18·76411	28
29	2·35657	·42435	45·21885	19·18846	29
30	2·42726	·41199	47·57542	19·60044	30
31	2·50008	·39999	50·00268	20·00043	31
32	2·57508	·38834	52·50276	20·38877	32
33	2·65234	·37703	55·07784	20·76579	33
34	2·73191	·36604	57·73018	21·13184	34
35	2·81386	·35538	60·46208	21·48722	35
36	2·89828	·34503	63·27594	21·83225	36
37	2·98523	·33498	66·17422	22·16724	37
38	3·07478	·32523	69·15945	22·49246	38
39	3·16703	·31575	72·23423	22·80822	39
40	3·26204	·30656	75·40126	23·11477	40
41	3·35990	·29763	78·66330	23·41240	41
42	3·46070	·28896	82·02320	23·70136	42
43	3·56452	·28054	85·48389	23·98190	43
44	3·67145	·27237	89·04841	24·25427	44
45	3·78160	·26444	92·71986	24·51871	45
46	3·89504	·25674	96·50146	24·77545	46
47	4·01190	·24926	100·39650	25·02471	47
48	4·13225	·24200	104·40840	25·26671	48
49	4·25622	·23495	108·54065	25·50166	49
50	4·38391	·22811	112·79687	25·72976	50

INTEREST TABLES

3%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	4.51542	.22146	117.18077	25.95123	51
52	4.65089	.21501	121.69620	26.16624	52
53	4.79041	.20875	126.34708	26.37499	53
54	4.93412	.20267	131.13749	26.57766	54
55	5.08215	.19677	136.07162	26.77443	55
56	5.23461	.19104	141.15377	26.96546	56
57	5.39165	.18547	146.38838	27.15094	57
58	5.55340	.18007	151.78003	27.33101	58
59	5.72000	.17483	157.33343	27.50583	59
60	5.89160	.16973	163.05344	27.67556	60
61	6.06835	.16479	168.94504	27.84035	61
62	6.25040	.15999	175.01339	28.00034	62
63	6.43791	.15533	181.26379	28.15567	63
64	6.63105	.15081	187.70171	28.30648	64
65	6.82998	.14641	194.33276	28.45289	65
66	7.03488	.14215	201.16274	28.59504	66
67	7.24593	.13801	208.19762	28.73305	67
68	7.46331	.13399	215.44355	28.86704	68
69	7.68721	.13009	222.90686	28.99712	69
70	7.91782	.12630	230.59406	29.12342	70
71	8.15536	.12262	238.51189	29.24604	71
72	8.40002	.11905	246.66724	29.36509	72
73	8.65202	.11558	255.06726	29.48067	73
74	8.91158	.11221	263.71928	29.59288	74
75	9.17893	.10895	272.63086	29.70183	75
76	9.45429	.10577	281.80978	29.80760	76
77	9.73792	.10269	291.26407	29.91029	77
78	10.03006	.09970	301.00200	30.00999	78
79	10.33096	.09680	311.03206	30.10679	79
80	10.64089	.09398	321.36302	30.20076	80
81	10.96012	.09124	332.00391	30.29200	81
82	11.28892	.08858	342.96403	30.38059	82
83	11.62759	.08600	354.25295	30.46659	83
84	11.97642	.08350	365.88054	30.55009	84
85	12.33571	.08107	377.85695	30.63115	85
86	12.70578	.07870	390.19266	30.70986	86
87	13.08695	.07641	402.89844	30.78627	87
88	13.47956	.07419	415.98539	30.86045	88
89	13.88395	.07203	429.46495	30.93248	89
90	14.30047	.06993	443.34890	31.00241	90
91	14.72948	.06789	457.64937	31.07030	91
92	15.17137	.06591	472.37885	31.13621	92
93	15.62651	.06399	487.55022	31.20021	93
94	16.09530	.06213	503.17672	31.26234	94
95	16.57816	.06032	519.27203	31.32266	95
96	17.07551	.05856	535.85019	31.38122	96
97	17.58777	.05686	552.92569	31.43808	97
98	18.11540	.05520	570.51346	31.49328	98
99	18.65887	.05359	588.62887	31.54687	99
100	19.21863	.05203	607.28773	31.59891	100

$3\frac{1}{2}\%$

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'03500	'96618	1'00000	'96618	1
2	1'07122	'93351	2'03500	1'89969	2
3	1'10872	'90194	3'10623	2'80164	3
4	1'14752	'87144	4'21494	3'67308	4
5	1'18769	'84197	5'36247	4'51505	5
6	1'22926	'81350	6'55015	5'32855	6
7	1'27228	'78599	7'77941	6'11454	7
8	1'31681	'75941	9'05169	6'87396	8
9	1'36290	'73373	10'36850	7'60769	9
10	1'41060	'70892	11'73139	8'31661	10
11	1'45997	'68495	13'14199	9'00155	11
12	1'51107	'66178	14'60196	9'66333	12
13	1'56396	'63940	16'11303	10'30274	13
14	1'61869	'61778	17'67699	10'92052	14
15	1'67535	'59689	19'29568	11'51741	15
16	1'73399	'57671	20'97103	12'09412	16
17	1'79467	'55720	22'70501	12'65132	17
18	1'85749	'53836	24'49969	13'18968	18
19	1'92250	'52016	26'35718	13'70984	19
20	1'98979	'50257	28'27968	14'21240	20
21	2'05943	'48557	30'26947	14'69797	21
22	2'13151	'46915	32'32890	15'16713	22
23	2'20611	'45329	34'46041	15'62041	23
24	2'28333	'43796	36'66653	16'05837	24
25	2'36324	'42315	38'94986	16'48152	25
26	2'44596	'40884	41'31310	16'89035	26
27	2'53157	'39501	43'75906	17'28537	27
28	2'62017	'38165	46'29063	17'66702	28
29	2'71188	'36875	48'91080	18'03577	29
30	2'80679	'35628	51'62267	18'39205	30
31	2'90503	'34423	54'42947	18'73628	31
32	3'00671	'33259	57'33450	19'06887	32
33	3'11194	'32134	60'34121	19'39021	33
34	3'22086	'31048	63'45315	19'70068	34
35	3'33359	'29998	66'67401	20'00066	35
36	3'45027	'28983	70'00760	20'29049	36
37	3'57103	'28003	73'45787	20'57053	37
38	3'69601	'27056	77'02889	20'84109	38
39	3'82537	'26141	80'72490	21'10250	39
40	3'95926	'25257	84'55028	21'35507	40
41	4'09783	'24403	88'50953	21'59910	41
42	4'24126	'23578	92'60737	21'83488	42
43	4'38970	'22781	96'84863	22'06269	43
44	4'54334	'22010	101'23833	22'28279	44
45	4'70236	'21266	105'78167	22'49545	45
46	4'86694	'20547	110'48403	22'70092	46
47	5'03728	'19852	115'35097	22'89944	47
48	5'21359	'19181	120'38826	23'09125	48
49	5'39606	'18532	125'60184	23'27657	49
50	5'58493	'17905	130'99791	23'45562	50

INTEREST TABLES

3¹/₂%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	5.78040	.17300	136.58283	23.62862	51
52	5.98271	.16714	142.36324	23.79577	52
53	6.19211	.16150	148.34595	23.95726	53
54	6.40883	.15603	154.53805	24.11330	54
55	6.63314	.15076	160.94689	24.26405	55
56	6.86530	.14566	167.58003	24.40971	56
57	7.10559	.14073	174.44533	24.55045	57
58	7.35428	.13598	181.55092	24.68642	58
59	7.61168	.13138	188.90520	24.81780	59
60	7.87809	.12693	196.51688	24.94474	60
61	8.15382	.12264	204.39497	25.06738	61
62	8.43921	.11849	212.54879	25.18587	62
63	8.73458	.11449	220.98800	25.30036	63
64	9.04029	.11062	229.72258	25.41097	64
65	9.35670	.10688	238.76287	25.51785	65
66	9.68418	.10326	248.11957	25.62111	66
67	10.02313	.09977	257.80376	25.72088	67
68	10.37394	.09640	267.82689	25.81728	68
69	10.73703	.09314	278.20083	25.91041	69
70	11.11282	.08999	288.93786	26.00040	70
71	11.50177	.08694	300.05069	26.08734	71
72	11.90434	.08400	311.55244	26.17134	72
73	12.32099	.08116	323.45680	26.25251	73
74	12.75222	.07842	335.77778	26.33092	74
75	13.19855	.07577	348.53001	26.40669	75
76	13.66050	.07320	361.72856	26.47989	76
77	14.13862	.07073	375.38906	26.55062	77
78	14.63347	.06834	389.52768	26.61896	78
79	15.14564	.06603	404.16115	26.68498	79
80	15.67574	.06379	419.30678	26.74878	80
81	16.22439	.06164	434.98252	26.81041	81
82	16.79224	.05955	451.20691	26.86996	82
83	17.37997	.05754	467.99915	26.92750	83
84	17.98827	.05559	485.37912	26.98309	84
85	18.61786	.05371	503.36739	27.03680	85
86	19.26948	.05190	521.98525	27.08870	86
87	19.94391	.05014	541.25474	27.13884	87
88	20.64195	.04845	561.19865	27.18729	88
89	21.36442	.04681	581.84060	27.23409	89
90	22.11217	.04522	603.20503	27.27932	90
91	22.88610	.04369	625.31720	27.32301	91
92	23.68711	.04222	648.20330	27.36523	92
93	24.51616	.04079	671.89042	27.40602	93
94	25.37423	.03941	696.40658	27.44543	94
95	26.26233	.03808	721.78082	27.48351	95
96	27.18151	.03679	748.04314	27.52029	96
97	28.13286	.03555	775.22465	27.55584	97
98	29.11751	.03434	803.35752	27.59018	98
99	30.13662	.03318	832.47503	27.62337	99
100	31.19141	.03206	862.61166	27.65543	100

4%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'04000	'96154	1'00000	'96154	1
2	1'08160	'92456	2'04000	1'88609	2
3	1'12486	'88900	3'12160	2'77509	3
4	1'16986	'85480	4'24646	3'62990	4
5	1'21665	'82193	5'41632	4'45182	5
6	1'26532	'79031	6'63298	5'24214	6
7	1'31593	'75992	7'89829	6'00205	7
8	1'36857	'73069	9'21423	6'73275	8
9	1'42331	'70259	10'58280	7'43533	9
10	1'48024	'67556	12'00611	8'11090	10
11	1'53945	'64958	13'48635	8'76048	11
12	1'60103	'62460	15'02581	9'38507	12
13	1'66507	'60057	16'62684	9'98565	13
14	1'73168	'57748	18'29191	10'56312	14
15	1'80094	'55526	20'02359	11'11839	15
16	1'87298	'53391	21'82453	11'65230	16
17	1'94790	'51337	23'69751	12'16567	17
18	2'02582	'49363	25'64541	12'65930	18
19	2'10685	'47464	27'67123	13'13394	19
20	2'19112	'45639	29'77808	13'59033	20
21	2'27877	'43883	31'96920	14'02916	21
22	2'36992	'42196	34'24797	14'45112	22
23	2'46472	'40573	36'61789	14'85684	23
24	2'56330	'39012	39'08260	15'24696	24
25	2'66584	'37512	41'64591	15'62208	25
26	2'77247	'36069	44'31174	15'98277	26
27	2'88337	'34682	47'08421	16'32959	27
28	2'99870	'33348	49'96758	16'66306	28
29	3'11865	'32065	52'96629	16'98372	29
30	3'24340	'30832	56'08494	17'29203	30
31	3'37313	'29646	59'32834	17'58849	31
32	3'50806	'28506	62'70147	17'87355	32
33	3'64838	'27409	66'20953	18'14765	33
34	3'79432	'26355	69'85791	18'41120	34
35	3'94609	'25342	73'65222	18'66461	35
36	4'10393	'24367	77'59831	18'90828	36
37	4'26809	'23430	81'70225	19'14258	37
38	4'43881	'22529	85'97034	19'36787	38
39	4'61637	'21662	90'40915	19'58449	39
40	4'80102	'20829	95'02552	19'79277	40
41	4'99306	'20028	99'82654	19'99305	41
42	5'19278	'19257	104'81960	20'18563	42
43	5'40050	'18517	110'01238	20'37080	43
44	5'61652	'17805	115'41288	20'54884	44
45	5'84118	'17120	121'02939	20'72004	45
46	6'07482	'16461	126'87057	20'88465	46
47	6'31782	'15828	132'94539	21'04294	47
48	6'57053	'15219	139'26321	21'19513	48
49	6'83335	'14634	145'83373	21'34147	49
50	7'10668	'14071	152'66708	21'48219	50

INTEREST TABLES

4%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	7.39095	.13530	159.77377	21.61749	51
52	7.68659	.13010	167.16472	21.74758	52
53	7.99405	.12509	174.85131	21.87268	53
54	8.31381	.12028	182.84536	21.99296	54
55	8.64637	.11566	191.15917	22.10861	55
56	8.99222	.11121	199.80554	22.21982	56
57	9.35191	.10693	208.79776	22.32675	57
58	9.72599	.10282	218.14967	22.42957	58
59	10.11503	.09886	227.87566	22.52843	59
60	10.51963	.09506	237.99069	22.62349	60
61	10.94041	.09140	248.51031	22.71490	61
62	11.37803	.08789	259.45073	22.80278	62
63	11.83315	.08451	270.82875	22.88729	63
64	12.30648	.08126	282.66190	22.96855	64
65	12.79874	.07813	294.96838	23.04668	65
66	13.31068	.07513	307.76712	23.12181	66
67	13.84311	.07224	321.07780	23.19405	67
68	14.39684	.06946	334.92091	23.26351	68
69	14.97271	.06679	349.31775	23.33030	69
70	15.57162	.06422	364.29046	23.39452	70
71	16.19448	.06175	379.86208	23.45627	71
72	16.84226	.05937	396.05656	23.51564	72
73	17.51595	.05709	412.89892	23.57273	73
74	18.21659	.05490	430.41478	23.62763	74
75	18.94525	.05278	448.63137	23.68041	75
76	19.70307	.05075	467.57662	23.73116	76
77	20.49119	.04880	487.27969	23.77996	77
78	21.31084	.04692	507.77087	23.82689	78
79	22.16327	.04512	529.08171	23.87201	79
80	23.04980	.04338	551.24498	23.91539	80
81	23.97179	.04172	574.29478	23.95711	81
82	24.93066	.04011	598.26657	23.99722	82
83	25.92789	.03857	623.19723	24.03579	83
84	26.96500	.03709	649.12512	24.07287	84
85	28.04360	.03566	676.09012	24.10853	85
86	29.16535	.03429	704.13373	24.14282	86
87	30.33196	.03297	733.29908	24.17579	87
88	31.54524	.03170	763.63104	24.20749	88
89	32.80705	.03048	795.17628	24.23797	89
90	34.11933	.02931	827.98333	24.26728	90
91	35.48411	.02818	862.10267	24.29546	91
92	36.90347	.02710	897.58677	24.32256	92
93	38.37961	.02606	934.49024	24.34861	93
94	39.91479	.02505	972.86985	24.37367	94
95	41.51139	.02409	1012.78465	24.39776	95
96	43.17184	.02316	1054.29603	24.42092	96
97	44.89872	.02227	1097.46788	24.44319	97
98	46.69467	.02142	1142.36659	24.46461	98
99	48.56245	.02059	1189.06125	24.48520	99
100	50.50495	.01980	1237.62370	24.50500	100

4½%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1.04500	.95694	1.00000	.95694	1
2	1.09203	.91573	2.04500	1.87267	2
3	1.14117	.87630	3.13702	2.74896	3
4	1.19252	.83856	4.27819	3.58753	4
5	1.24618	.80245	5.47071	4.38998	5
6	1.30226	.76790	6.71689	5.15787	6
7	1.36086	.73483	8.01915	5.89270	7
8	1.42210	.70319	9.38001	6.59589	8
9	1.48610	.67290	10.80211	7.26879	9
10	1.55297	.64393	12.28821	7.91272	10
11	1.62285	.61620	13.84118	8.52892	11
12	1.69588	.58966	15.46403	9.11858	12
13	1.77220	.56427	17.15991	9.68285	13
14	1.85194	.53997	18.93210	10.22283	14
15	1.93528	.51672	20.78405	10.73955	15
16	2.02237	.49447	22.71933	11.23401	16
17	2.11338	.47318	24.74170	11.70719	17
18	2.20848	.45280	26.85508	12.15999	18
19	2.30786	.43330	29.06356	12.59329	19
20	2.41171	.41464	31.37142	13.00794	20
21	2.52024	.39679	33.78314	13.40472	21
22	2.63365	.37970	36.30338	13.78442	22
23	2.75217	.36335	38.93703	14.14777	23
24	2.87601	.34770	41.68919	14.49548	24
25	3.00543	.33273	44.56521	14.82821	25
26	3.14068	.31840	47.57064	15.14661	26
27	3.28201	.30469	50.71132	15.45130	27
28	3.42970	.29157	53.99333	15.74287	28
29	3.58404	.27901	57.42303	16.02189	29
30	3.74532	.26700	61.00707	16.28889	30
31	3.91386	.25550	64.75238	16.54439	31
32	4.08998	.24450	68.66624	16.78889	32
33	4.27403	.23397	72.75622	17.02286	33
34	4.46636	.22390	77.03026	17.24676	34
35	4.66735	.21425	81.49662	17.46101	35
36	4.87738	.20503	86.16396	17.66604	36
37	5.09686	.19620	91.04134	17.86224	37
38	5.32622	.18775	96.13820	18.04999	38
39	5.56590	.17967	101.46442	18.22966	39
40	5.81636	.17193	107.03032	18.40158	40
41	6.07810	.16453	112.84668	18.56611	41
42	6.35161	.15744	118.92479	18.72355	42
43	6.63744	.15066	125.27640	18.87421	43
44	6.93612	.14417	131.91384	18.01838	44
45	7.24825	.13796	138.84996	19.15635	45
46	7.57442	.13202	146.09821	19.28837	46
47	7.91527	.12634	153.67263	19.41471	47
48	8.27145	.12090	161.58790	19.53561	48
49	8.64367	.11569	169.85935	19.65130	49
50	9.03264	.11071	178.50303	19.76201	50

INTEREST TABLES

4½%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	9·43910	·10594	187·53566	19·86795	51
52	9·86386	·10138	196·97477	19·96933	52
53	10·30774	·09701	206·83863	20·06634	53
54	10·77159	·09284	217·14637	20·15918	54
55	11·25631	·08884	227·91796	20·24802	55
56	11·76284	·08501	239·17427	20·33303	56
57	12·29217	·08135	250·93711	20·41438	57
58	12·84532	·07785	263·22928	20·49224	58
59	13·42336	·07450	276·07459	20·56673	59
60	14·02741	·07129	289·49795	20·63802	60
61	14·65864	·06822	303·52536	20·70624	61
62	15·31828	·06528	318·18400	20·77152	62
63	16·00760	·06247	333·50228	20·83399	63
64	16·72794	·05978	349·50988	20·89377	64
65	17·48070	·05721	366·23783	20·95098	65
66	18·26733	·05474	383·71853	21·00572	66
67	19·08936	·05239	401·98586	21·05811	67
68	19·94838	·05013	421·07523	21·10824	68
69	20·84606	·04797	441·02362	21·15621	69
70	21·78413	·04590	461·86968	21·20211	70
71	22·76442	·04393	483·65381	21·24604	71
72	23·78882	·04204	506·41823	21·28808	72
73	24·85931	·04023	530·20706	21·32830	73
74	25·97798	·03849	555·06637	21·36680	74
75	27·14699	·03684	581·04436	21·40363	75
76	28·36861	·03525	608·19136	21·43888	76
77	29·64520	·03373	636·55997	21·47262	77
78	30·97923	·03228	666·20517	21·50490	78
79	32·37329	·03089	697·18440	21·53579	79
80	33·83009	·02956	729·55770	21·56534	80
81	35·35245	·02829	763·38779	21·59363	81
82	36·94331	·02707	798·74024	21·62070	82
83	38·60576	·02590	835·68355	21·64660	83
84	40·34302	·02479	874·28931	21·67139	84
85	42·15845	·02372	914·63233	21·69511	85
86	44·05558	·02270	956·79079	21·71781	86
87	46·03808	·02172	1000·84637	21·73953	87
88	48·10980	·02079	1046·88446	21·76032	88
89	50·27474	·01989	1094·99426	21·78021	89
90	52·53710	·01903	1145·26900	21·79924	90
91	54·90127	·01821	1197·80611	21·81746	91
92	57·37183	·01743	1252·70738	21·83489	92
93	59·95356	·01668	1310·07922	21·85156	93
94	62·65147	·01596	1370·03278	21·86753	94
95	65·47079	·01527	1432·68426	21·88280	95
96	68·41697	·01462	1498·15505	21·89742	96
97	71·49574	·01399	1566·57202	21·91140	97
98	74·71305	·01338	1638·06777	21·92479	98
99	78·07514	·01281	1712·78082	21·93760	99
100	81·58852	·01226	1790·85595	21·94985	100

5%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'05000	'95238	1'00000	'95238	1
2	1'10250	'90703	2'05000	1'85941	2
3	1'15763	'86384	3'15250	2'72325	3
4	1'21551	'82270	4'31013	3'54595	4
5	1'27628	'78353	5'52563	4'32948	5
6	1'34010	'74622	6'80191	5'07569	6
7	1'40710	'71068	8'14201	5'78637	7
8	1'47746	'67684	9'54911	6'46321	8
9	1'55133	'64461	11'02656	7'10782	9
10	1'62889	'61391	12'57789	7'72173	10
11	1'71034	'58468	14'20679	8'30641	11
12	1'79586	'55684	15'91713	8'86325	12
13	1'88565	'53032	17'71298	9'39357	13
14	1'97993	'50507	19'59863	9'89864	14
15	2'07893	'48102	21'57856	10'37966	15
16	2'18287	'45811	23'65749	10'83777	16
17	2'29202	'43630	25'84037	11'27407	17
18	2'40662	'41552	28'13238	11'68959	18
19	2'52695	'39573	30'53900	12'08532	19
20	2'65330	'37689	33'06595	12'46221	20
21	2'78596	'35894	35'71925	12'82115	21
22	2'92526	'34185	38'50521	13'16300	22
23	3'07152	'32557	41'43048	13'48857	23
24	3'22510	'31007	44'50200	13'79864	24
25	3'38635	'29530	47'72710	14'09394	25
26	3'55567	'28124	51'11345	14'37518	26
27	3'73346	'26785	54'66913	14'64303	27
28	3'92013	'25509	58'40258	14'89813	28
29	4'11614	'24295	62'32271	15'14107	29
30	4'32194	'23138	66'43885	15'37245	30
31	4'53804	'22036	70'76079	15'59281	31
32	4'76494	'20987	75'29883	15'80268	32
33	5'00319	'19987	80'06377	16'00255	33
34	5'25335	'19035	85'06696	16'19290	34
35	5'51602	'18129	90'32031	16'37419	35
36	5'79182	'17266	95'83632	16'54685	36
37	6'08141	'16444	101'62814	16'71129	37
38	6'38548	'15661	107'70955	16'86789	38
39	6'70475	'14915	114'09502	17'01704	39
40	7'03999	'14205	120'79977	17'15909	40
41	7'39199	'13528	127'83976	17'29437	41
42	7'76159	'12884	135'23175	17'42321	42
43	8'14967	'12270	142'99334	17'54591	43
44	8'55715	'11686	151'14301	17'66277	44
45	8'98501	'11130	159'70016	17'77407	45
46	9'43426	'10600	168'68516	17'88007	46
47	9'90597	'10095	178'11942	17'98101	47
48	10'40127	'09614	188'02539	18'07716	48
49	10'92133	'09156	198'42666	18'16872	49
50	11'46740	'08720	209'34800	18'25592	50

INTEREST TABLES

5%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	12·04077	·08305	220·81540	18·33898	51
52	12·64281	·07910	232·85617	18·41807	52
53	13·27495	·07533	245·49897	18·49340	53
54	13·93870	·07174	258·77392	18·56514	54
55	14·63563	·06833	272·71262	18·63347	55
56	15·36741	·06507	287·34825	18·69854	56
57	16·13578	·06197	302·71566	18·76052	57
58	16·94257	·05902	318·85144	18·81954	58
59	17·78970	·05621	335·79402	18·87575	59
60	18·67919	·05354	353·58372	18·92929	60
61	19·61315	·05099	372·26290	18·98027	61
62	20·59380	·04856	391·87605	19·02883	62
63	21·62349	·04625	412·46985	19·07508	63
64	22·70467	·04404	434·09334	19·11912	64
65	23·83990	·04195	456·79801	19·16107	65
66	25·03190	·03995	480·63791	19·20102	66
67	26·28349	·03805	505·66981	19·23907	67
68	27·59766	·03623	531·95330	19·27530	68
69	28·97755	·03451	559·55096	19·30981	69
70	30·42643	·03287	588·52851	19·34268	70
71	31·94775	·03130	618·95494	19·37398	71
72	33·54513	·02981	650·90268	19·40379	72
73	35·22239	·02839	684·44782	19·43218	73
74	36·98351	·02704	719·67021	19·45922	74
75	38·83269	·02575	756·65372	19·48497	75
76	40·77432	·02453	795·48640	19·50949	76
77	42·81304	·02336	836·26072	19·53285	77
78	44·95369	·02225	879·07376	19·55510	78
79	47·20137	·02119	924·02745	19·57628	79
80	49·56144	·02018	971·22882	19·59646	80
81	52·03951	·01922	1020·79026	19·61568	81
82	54·64149	·01830	1072·82978	19·63398	82
83	57·37356	·01743	1127·47126	19·65141	83
84	60·24224	·01660	1184·84483	19·66801	84
85	63·25435	·01581	1245·08707	19·68382	85
86	66·41707	·01506	1308·34142	19·69887	86
87	69·73792	·01434	1374·75849	19·71321	87
88	73·22482	·01366	1444·49642	19·72687	88
89	76·88606	·01301	1517·72124	19·73987	89
90	80·73037	·01239	1594·60730	19·75226	90
91	84·76688	·01180	1675·33767	19·76406	91
92	89·00523	·01124	1760·10455	19·77529	92
93	93·45549	·01070	1849·10978	19·78599	93
94	98·12826	·01019	1942·56527	19·79618	94
95	103·03468	·00971	2040·69353	19·80589	95
96	108·18641	·00924	2143·72821	19·81513	96
97	113·59573	·00880	2251·91462	19·82394	97
98	119·27552	·00838	2365·51035	19·83232	98
99	125·23929	·00798	2484·78586	19·84030	99
100	131·50126	·00760	2610·02516	19·84791	100

6%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'06000	'94340	1'00000	'94340	1
2	1'12360	'89000	2'06000	1'83339	2
3	1'19102	'83962	3'18360	2'67301	3
4	1'26248	'79209	4'37462	3'46511	4
5	1'33823	'74726	5'63709	4'21236	5
6	1'41852	'70496	6'97532	4'91732	6
7	1'50363	'66506	8'39384	5'58238	7
8	1'59385	'62741	9'89747	6'20979	8
9	1'68948	'59190	11'49132	6'80169	9
10	1'79085	'55839	13'18079	7'36009	10
11	1'89830	'52679	14'97164	7'88687	11
12	2'01220	'49697	16'86094	8'38384	12
13	2'13293	'46884	18'88214	8'85268	13
14	2'26090	'44230	21'01507	9'29498	14
15	2'39656	'41727	23'27597	9'71225	15
16	2'54035	'39365	25'67253	10'10590	16
17	2'69277	'37136	28'21288	10'47726	17
18	2'85434	'35034	30'90565	10'82760	18
19	3'02560	'33051	33'75999	11'15812	19
20	3'20714	'31180	36'78559	11'46992	20
21	3'39956	'29416	39'99273	11'76408	21
22	3'60354	'27751	43'39229	12'04158	22
23	3'81975	'26180	46'99583	12'30338	23
24	4'04893	'24698	50'81558	12'55036	24
25	4'29187	'23300	54'86451	12'78336	25
26	4'54938	'21981	59'15638	13'00317	26
27	4'82235	'20737	63'70577	13'21053	27
28	5'11169	'19563	68'52811	13'40616	28
29	5'41839	'18456	73'63980	13'59072	29
30	5'74349	'17411	79'05819	13'76483	30
31	6'08810	'16425	84'80168	13'92909	31
32	6'45339	'15496	90'88978	14'08404	32
33	6'84059	'14619	97'34316	14'23023	33
34	7'25103	'13791	104'18375	14'36814	34
35	7'68609	'13011	111'43478	14'49825	35
36	8'14725	'12274	119'12087	14'62099	36
37	8'63609	'11579	127'26812	14'73678	37
38	9'15425	'10924	135'90421	14'84602	38
39	9'70351	'10306	145'05846	14'94907	39
40	10'28572	'09722	154'76197	15'04630	40
41	10'90286	'09172	165'04768	15'13802	41
42	11'55703	'08653	175'95054	15'22454	42
43	12'25045	'08163	187'50758	15'30617	43
44	12'98548	'07701	199'75803	15'38318	44
45	13'76461	'07265	212'74351	15'45583	45
46	14'59049	'06854	226'50812	15'52437	46
47	15'46592	'06466	241'09861	15'58903	47
48	16'39387	'06100	256'56453	15'65003	48
49	17'37750	'05755	272'95841	15'70757	49
50	18'42015	'05429	290'33590	15'76186	50

INTEREST TABLES

6%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	19·52536	·05122	308·75606	15·81308	51
52	20·69689	·04832	328·28142	15·86139	52
53	21·93870	·04558	348·97831	15·90697	53
54	23·25502	·04300	370·91701	15·94998	54
55	24·65032	·04057	394·17203	15·99054	55
56	26·12934	·03827	418·82235	16·02881	56
57	27·69710	·03610	444·95169	16·06492	57
58	29·35893	·03406	472·64879	16·09898	58
59	31·12046	·03213	502·00772	16·13111	59
60	32·98769	·03031	533·12818	16·16143	60
61	34·96695	·02860	566·11587	16·19003	61
62	37·06497	·02698	601·08282	16·21701	62
63	39·28887	·02545	638·14779	16·24246	63
64	41·64620	·02401	677·43666	16·26647	64
65	44·14497	·02265	719·08286	16·28912	65
66	46·79367	·02137	763·22783	16·31049	66
67	49·60129	·02016	810·02150	16·33065	67
68	52·57737	·01902	859·62279	16·34967	68
69	55·73201	·01794	912·20016	16·36792	69
70	59·07593	·01693	967·93217	16·38454	70
71	62·62049	·01597	1027·00810	16·40051	71
72	66·37772	·01507	1089·62859	16·41158	72
73	70·36038	·01421	1156·00630	16·42979	73
74	74·58200	·01341	1226·36668	16·44320	74
75	79·05692	·01265	1300·94868	16·45585	75
76	83·80034	·01193	1380·00560	16·46778	76
77	88·82836	·01126	1463·80594	16·47904	77
78	94·15806	·01062	1552·63429	16·48966	78
79	99·80754	·01002	1646·79235	16·49968	79
80	105·79599	·00945	1746·59989	16·50913	80
81	112·14375	·00892	1852·39588	16·51805	81
82	118·87238	·00841	1964·53964	16·52646	82
83	126·00472	·00794	2083·41202	16·53440	83
84	133·56500	·00749	2209·41674	16·54188	84
85	141·57890	·00706	2342·98174	16·54895	85
86	150·07364	·00666	2484·56065	16·55561	86
87	159·07806	·00629	2634·63428	16·56190	87
88	168·72274	·00593	2793·71234	16·56783	88
89	178·74010	·00559	2962·33508	16·57342	89
90	189·46451	·00528	3141·07519	16·57870	90
91	200·83238	·00498	3330·53970	16·58368	91
92	212·88232	·00470	3531·37208	16·58838	92
93	225·65526	·00443	3744·25441	16·59281	93
94	239·19458	·00418	3969·90967	16·59699	94
95	253·54625	·00394	4209·10425	16·60093	95
96	268·75903	·00372	4462·65050	16·60465	96
97	284·88457	·00351	4731·40953	16·60816	97
98	301·97765	·00331	5016·29411	16·61147	98
99	320·09631	·00312	5318·27175	16·61460	99
100	339·30208	·00295	5638·36806	16·61755	100

7%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1·07000	·93458	1·00000	·93458	1
2	1·14490	·87344	2·07000	1·80802	2
3	1·22504	·81630	3·21490	2·62432	3
4	1·31080	·76290	4·43994	3·38721	4
5	1·40255	·71299	5·75074	4·10020	5
6	1·50073	·66634	7·15329	4·76654	6
7	1·60578	·62275	8·65402	5·38929	7
8	1·71819	·58201	10·25980	5·97130	8
9	1·83846	·54393	11·97799	6·51523	9
10	1·96715	·50835	13·81645	7·02358	10
11	2·10485	·47509	15·78360	7·49867	11
12	2·25219	·44401	17·88845	7·94269	12
13	2·40985	·41496	20·14064	8·35765	13
14	2·57853	·38782	22·55049	8·74547	14
15	2·75903	·36245	25·12902	9·10791	15
16	2·95216	·33873	27·88805	9·44665	16
17	3·15882	·31657	30·84022	9·76322	17
18	3·37993	·29586	33·99903	10·05909	18
19	3·61653	·27651	37·37896	10·33560	19
20	3·86968	·25842	40·99549	10·59401	20
21	4·14056	·24151	44·86518	10·83553	21
22	4·43040	·22571	49·00574	11·06124	22
23	4·74053	·21095	53·43614	11·27219	23
24	5·07237	·19715	58·17667	11·46933	24
25	5·42743	·18425	63·24904	11·65358	25
26	5·80735	·17220	68·67647	11·82578	26
27	6·21387	·16093	74·48382	11·98671	27
28	6·64884	·15040	80·69769	12·13711	28
29	7·11426	·14056	87·34653	12·27767	29
30	7·61226	·13137	94·46079	12·40904	30
31	8·14511	·12277	102·07304	12·53181	31
32	8·71527	·11474	110·21815	12·64656	32
33	9·32534	·10723	118·93343	12·75379	33
34	9·97811	·10022	128·25876	12·85401	34
35	10·67658	·09366	138·23688	12·94767	35
36	11·42394	·08754	148·91346	13·03521	36
37	12·22362	·08181	160·33740	13·11702	37
38	13·07927	·07646	172·56102	13·19347	38
39	13·99482	·07146	185·64029	13·26493	39
40	14·97446	·06678	199·63511	13·33171	40
41	16·02267	·06241	214·60957	13·39412	41
42	17·14426	·05833	230·63224	13·45245	42
43	18·34435	·05451	247·77650	13·50696	43
44	19·62846	·05095	266·12085	13·55791	44
45	21·00245	·04761	285·74931	13·60552	45
46	22·47262	·04450	306·75176	13·65002	46
47	24·04571	·04159	329·22439	13·69161	47
48	25·72891	·03887	353·27009	13·73047	48
49	27·52993	·03632	378·99900	13·76680	49
50	29·45703	·03395	406·52893	13·80075	50

INTEREST TABLES

7%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	31·51902	·03173	435·98595	13·83247	51
52	33·72535	·02965	467·50497	13·86212	52
53	36·08612	·02771	501·23032	13·88984	53
54	38·61215	·02590	537·31644	13·91573	54
55	41·31500	·02420	575·92859	13·93994	55
56	44·20705	·02262	617·24359	13·96256	56
57	47·30155	·02114	661·45065	13·98370	57
58	50·61265	·01976	708·75219	14·00346	58
59	54·15554	·01847	759·36484	14·02192	59
60	57·94644	·01726	813·52038	14·03918	60
61	62·00267	·01613	871·46681	14·05531	61
62	66·34286	·01507	933·46949	14·07038	62
63	70·98686	·01409	999·81235	14·08447	63
64	75·95594	·01317	1070·79922	14·09764	64
65	81·27285	·01230	1146·75516	14·10994	65
66	86·96195	·01150	1228·02802	14·12144	66
67	93·04929	·01075	1314·98998	14·13219	67
68	99·56274	·01004	1408·03928	14·14223	68
69	106·53213	·00939	1507·60203	14·15162	69
70	113·98938	·00877	1614·13417	14·16039	70
71	121·96864	·00820	1728·12357	14·16859	71
72	130·50644	·00766	1850·09222	14·17625	72
73	139·64189	·00716	1980·59867	14·18341	73
74	149·41682	·00669	2120·24058	14·19010	74
75	159·87600	·00625	2269·65742	14·19636	75
76	171·06732	·00585	2429·53344	14·20220	76
77	183·04203	·00546	2600·60078	14·20767	77
78	195·85498	·00511	2783·64283	14·21277	78
79	209·56483	·00477	2979·49783	14·21755	79
80	224·23437	·00446	3189·06268	14·22201	80
81	239·93077	·00417	3413·29707	14·22617	81
82	256·72592	·00390	3653·22786	14·23007	82
83	274·69674	·00364	3909·95381	14·23371	83
84	293·92551	·00340	4184·65058	14·23711	84
85	314·50029	·00318	4478·57612	14·24029	85
86	336·51531	·00297	4793·07645	14·24326	86
87	360·07139	·00278	5129·59180	14·24604	87
88	385·27638	·00260	5489·66323	14·24863	88
89	412·24573	·00243	5874·93965	14·25106	89
90	441·10293	·00227	6287·18543	14·25333	90
91	471·98014	·00212	6728·28841	14·25545	91
92	505·01875	·00198	7200·26859	14·25743	92
93	540·37006	·00185	7705·28740	14·25928	93
94	578·19596	·00173	8245·65751	14·26101	94
95	618·66968	·00162	8823·85354	14·26262	95
96	661·97656	·00151	9442·52329	14·26413	96
97	708·31492	·00141	10104·49992	14·26555	97
98	757·89696	·00132	10812·81491	14·26686	98
99	810·94975	·00123	11570·71196	14·26810	99
100	867·71623	·00115	12381·66179	14·26925	100

8%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1.08000	.92593	1.00000	.92593	1
2	1.16640	.85734	2.08000	1.78326	2
3	1.25971	.79383	3.24640	2.57710	3
4	1.36049	.73503	4.50611	3.31213	4
5	1.46933	.68058	5.86660	3.99271	5
6	1.58687	.63017	7.33593	4.62288	6
7	1.71382	.58349	8.92280	5.20637	7
8	1.85093	.54027	10.63663	5.74664	8
9	1.99900	.50025	12.48756	6.24689	9
10	2.15892	.46319	14.48656	6.71008	10
11	2.33164	.42888	16.64549	7.13896	11
12	2.51817	.39711	18.97713	7.53608	12
13	2.71962	.36770	21.49530	7.90378	13
14	2.93719	.34046	24.21492	8.24424	14
15	3.17217	.31524	27.15211	8.55948	15
16	3.42594	.29189	30.32428	8.85137	16
17	3.70002	.27027	33.75023	9.12164	17
18	3.99602	.25025	37.45024	9.37189	18
19	4.31570	.23171	41.44626	9.60360	19
20	4.66096	.21455	45.76196	9.81815	20
21	5.03383	.19866	50.42292	10.01680	21
22	5.43654	.18394	55.45676	10.20074	22
23	5.87146	.17032	60.89330	10.37106	23
24	6.34118	.15770	66.76476	10.52876	24
25	6.84848	.14602	73.10594	10.67478	25
26	7.39635	.13520	79.95442	10.80998	26
27	7.98806	.12519	87.35077	10.93516	27
28	8.62711	.11591	95.33883	11.05108	28
29	9.31727	.10733	103.96593	11.15841	29
30	10.06266	.09938	113.28321	11.25778	30
31	10.86767	.09202	123.34587	11.34980	31
32	11.73708	.08520	134.21354	11.43500	32
33	12.67605	.07889	145.95062	11.51389	33
34	13.69013	.07305	158.62667	11.58693	34
35	14.78534	.06763	172.31680	11.65457	35
36	15.96817	.06262	187.10215	11.71719	36
37	17.24563	.05799	203.07032	11.77518	37
38	18.62528	.05369	220.31595	11.82887	38
39	20.11530	.04971	238.94122	11.87858	39
40	21.72452	.04603	259.05652	11.92461	40
41	23.46248	.04262	280.78104	11.96723	41
42	25.33948	.03946	304.24352	12.00670	42
43	27.36664	.03654	329.58301	12.04324	43
44	29.55597	.03383	356.94965	12.07707	44
45	31.92045	.03133	386.50562	12.10840	45
46	34.47409	.02901	418.42607	12.13741	46
47	37.23201	.02686	452.90015	12.16427	47
48	40.21057	.02487	490.13216	12.18914	48
49	43.42742	.02303	530.34274	12.21216	49
50	46.90161	.02132	573.77016	12.23348	50

INTEREST TABLES

8%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	50·65374	·01974	620·67177	12·25323	51
52	54·70604	·01828	671·32551	12·27151	52
53	59·08252	·01693	726·03155	12·28843	53
54	63·80913	·01567	785·11408	12·30410	54
55	68·91386	·01451	848·92320	12·31861	55
56	74·42696	·01344	917·83706	12·33205	56
57	80·38112	·01244	992·26402	12·34449	57
58	86·81161	·01152	1072·64514	12·35601	58
59	93·75654	·01067	1159·45676	12·36668	59
60	101·25706	·00988	1253·21330	12·37655	60
61	109·35763	·00914	1354·47036	12·38570	61
62	118·10624	·00847	1463·82799	12·39416	62
63	127·55474	·00784	1581·93423	12·40200	63
64	137·75912	·00726	1709·48897	12·40926	64
65	148·77985	·00672	1847·24808	12·41598	65
66	160·68223	·00622	1996·02793	12·42221	66
67	173·53681	·00576	2156·71016	12·42797	67
68	187·41976	·00534	2330·24698	12·43330	68
69	202·41334	·00494	2517·66673	12·43824	69
70	218·60641	·00457	2720·08007	12·44282	70
71	236·09492	·00424	2938·68648	12·44705	71
72	254·98251	·00392	3174·78140	12·45098	72
73	275·38111	·00363	3429·76391	12·45461	73
74	297·41160	·00336	3705·14502	12·45797	74
75	321·20453	·00311	4002·55662	12·46108	75
76	346·90089	·00288	4323·76115	12·46397	76
77	374·65296	·00267	4670·66205	12·46664	77
78	404·62520	·00247	5045·31501	12·46911	78
79	436·99522	·00229	5449·94021	12·47139	79
80	471·95483	·00212	5886·93543	12·47351	80
81	509·71122	·00196	6358·89026	12·47548	81
82	550·48812	·00182	6868·60148	12·47729	82
83	594·52717	·00168	7419·08960	12·47897	83
84	642·08934	·00156	8013·61677	12·48053	84
85	693·45649	·00144	8655·70611	12·48197	85
86	748·93301	·00134	9349·16260	12·48331	86
87	808·84765	·00124	10098·09561	12·48455	87
88	873·55546	·00114	10906·94326	12·48569	88
89	943·43990	·00106	11780·49872	12·48675	89
90	1018·91509	·00098	12723·93862	12·48773	90
91	1100·42830	·00091	13742·85370	12·48864	91
92	1188·46256	·00084	14843·28200	12·48948	92
93	1283·53956	·00078	16031·74456	12·49026	93
94	1386·22273	·00072	17315·28413	12·49098	94
95	1497·12055	·00067	18701·50686	12·49165	95
96	1616·89019	·00062	20198·62740	12·49227	96
97	1746·24141	·00057	21815·51760	12·49284	97
98	1885·94072	·00053	23561·75900	12·49337	98
99	2036·81598	·00049	25447·69972	12·49386	99
100	2199·76126	·00045	27484·51570	12·49432	100

9%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1.09000	.91743	1.00000	.91743	1
2	1.18810	.84168	2.09000	1.75911	2
3	1.29503	.77218	3.27810	2.53129	3
4	1.41158	.70843	4.57313	3.23972	4
5	1.53862	.64993	5.98471	3.88965	5
6	1.67710	.59627	7.52333	4.48592	6
7	1.82804	.54703	9.20043	5.03295	7
8	1.99256	.50187	11.02847	5.53482	8
9	2.17189	.46043	13.02104	5.99525	9
10	2.36736	.42241	15.19293	6.41766	10
11	2.58043	.38753	17.56029	6.80519	11
12	2.81266	.35553	20.14072	7.16073	12
13	3.06580	.32618	22.95338	7.48690	13
14	3.34173	.29925	26.01919	7.78615	14
15	3.64248	.27454	29.36092	8.06069	15
16	3.97031	.25187	33.00340	8.31256	16
17	4.32763	.23107	36.97370	8.54363	17
18	4.71712	.21199	41.30134	8.75563	18
19	5.14166	.19449	46.01846	8.95011	19
20	5.60441	.17843	51.16012	9.12855	20
21	6.10881	.16370	56.76453	9.29224	21
22	6.65860	.15018	62.87334	9.44243	22
23	7.25787	.13778	69.53914	9.58021	23
24	7.91108	.12640	76.78981	9.70661	24
25	8.62308	.11597	84.70090	9.82258	25
26	9.39916	.10639	93.32398	9.92897	26
27	10.24508	.09761	102.72313	10.02658	27
28	11.16714	.08955	112.96822	10.11613	28
29	12.17218	.08215	124.13536	10.19828	29
30	13.26768	.07537	136.30754	10.27365	30
31	14.46177	.06915	149.57522	10.34280	31
32	15.76333	.06344	164.03699	10.40624	32
33	17.18203	.05820	179.80032	10.46444	33
34	18.72841	.05339	196.98234	10.51784	34
35	20.41397	.04899	215.71075	10.56682	35
36	22.25123	.04494	236.12472	10.61176	36
37	24.25384	.04123	258.37595	10.65299	37
38	26.43668	.03783	282.62978	10.69082	38
39	28.81598	.03470	309.06646	10.72552	39
40	31.40942	.03184	337.88245	10.75736	40
41	34.23627	.02921	369.29187	10.78657	41
42	37.31753	.02680	403.52813	10.81337	42
43	40.67611	.02458	440.84566	10.83795	43
44	44.33696	.02255	481.52177	10.86051	44
45	48.32729	.02069	525.85873	10.88120	45
46	52.67674	.01898	574.18602	10.90018	46
47	57.41765	.01742	626.86276	10.91760	47
48	62.58524	.01598	684.28041	10.93358	48
49	68.21791	.01466	746.86565	10.94823	49
50	74.35752	.01345	815.08356	10.96168	50

INTEREST TABLES

9%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	81·04970	·01234	889·44108	10·97402	51
52	88·34417	·01132	970·49077	10·98534	52
53	96·29514	·01038	1058·83494	10·99573	53
54	104·96171	·00953	1155·13009	11·00525	54
55	114·40826	·00874	1260·09180	11·01399	55
56	124·70501	·00802	1374·50006	11·02201	56
57	135·92846	·00736	1499·20506	11·02937	57
58	148·16202	·00675	1635·13352	11·03612	58
59	161·49660	·00619	1783·29553	11·04231	59
60	176·03129	·00568	1944·79213	11·04799	60
61	191·87411	·00521	2120·82342	11·05320	61
62	209·14278	·00478	2312·69753	11·05798	62
63	227·96563	·00439	2521·84031	11·06237	63
64	248·48253	·00402	2749·80594	11·06640	64
65	270·84596	·00369	2998·28847	11·07009	65
66	295·22210	·00339	3269·13444	11·07347	66
67	321·79209	·00311	3564·35654	11·07658	67
68	350·75338	·00285	3886·14862	11·07943	68
69	382·32118	·00262	4236·90200	11·08205	69
70	416·73009	·00240	4619·22318	11·08445	70
71	454·23579	·00220	5035·95327	11·08665	71
72	495·11702	·00202	5490·18906	11·08867	72
73	539·67755	·00185	5985·30608	11·09052	73
74	588·24853	·00170	6524·98362	11·09222	74
75	641·19089	·00156	7113·23215	11·09378	75
76	698·89807	·00143	7754·42304	11·09521	76
77	761·79890	·00131	8453·32112	11·09653	77
78	830·36080	·00120	9215·12002	11·09773	78
79	905·09327	·00110	10045·48082	11·09883	79
80	986·55167	·00101	10950·57409	11·09985	80
81	1075·34132	·00093	11937·12576	11·10078	81
82	1172·12204	·00085	13012·46708	11·10163	82
83	1277·61302	·00078	14184·58911	11·10241	83
84	1392·59819	·00072	15462·20213	11·10313	84
85	1517·93203	·00066	16854·80033	11·10379	85
86	1654·54591	·00060	18372·73236	11·10440	86
87	1803·45504	·00055	20027·27827	11·10495	87
88	1965·76600	·00051	21830·73331	11·10546	88
89	2142·68494	·00047	23796·49931	11·10593	89
90	2335·52658	·00043	25939·18425	11·10635	90
91	2545·72397	·00039	28274·71083	11·10675	91
92	2774·83913	·00036	30820·43481	11·10711	92
93	3024·57465	·00033	33595·27394	11·10744	93
94	3296·78637	·00030	36619·84859	11·10774	94
95	3593·49715	·00028	39916·63497	11·10802	95
96	3916·91189	·00026	43510·13211	11·10827	96
97	4269·43396	·00023	47427·04400	11·10851	97
98	4653·68302	·00021	51696·47796	11·10872	98
99	5072·51449	·00020	56350·16098	11·10892	99
100	5529·04079	·00018	61422·67547	11·10910	100

10%

INTEREST TABLES

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
1	1'10000	'90909	1'00000	'90909	1
2	1'21000	'82645	2'10000	1'73554	2
3	1'33100	'75131	3'31000	2'48685	3
4	1'46410	'68301	4'64100	3'16987	4
5	1'61051	'62092	6'10510	3'79079	5
6	1'77156	'56447	7'71561	4'35526	6
7	1'94872	'51316	9'48717	4'86842	7
8	2'14359	'46651	11'43589	5'33493	8
9	2'35795	'42410	13'57948	5'75902	9
10	2'59374	'38554	15'93742	6'14457	10
11	2'85312	'35049	18'53117	6'49506	11
12	3'13843	'31863	21'38428	6'81369	12
13	3'45227	'28966	24'52271	7'10336	13
14	3'79750	'26333	27'97498	7'36669	14
15	4'17725	'23939	31'77248	7'60608	15
16	4'59497	'21763	35'94973	7'82371	16
17	5'05447	'19784	40'54470	8'02155	17
18	5'55992	'17986	45'59917	8'20141	18
19	6'11591	'16351	51'15909	8'36492	19
20	6'72750	'14864	57'27500	8'51356	20
21	7'40025	'13513	64'00250	8'64869	21
22	8'14027	'12285	71'40275	8'77154	22
23	8'95430	'11168	79'54302	8'88322	23
24	9'84973	'10153	88'49733	8'98474	24
25	10'83471	'09230	98'34706	9'07704	25
26	11'91818	'08391	109'18177	9'16095	26
27	13'10999	'07628	121'09994	9'23722	27
28	14'42099	'06934	134'20994	9'30657	28
29	15'86309	'06304	148'63093	9'36961	29
30	17'44940	'05731	164'49402	9'42691	30
31	19'19434	'05210	181'94342	9'47901	31
32	21'11378	'04736	201'13777	9'52638	32
33	23'22515	'04306	222'25154	9'56943	33
34	25'54767	'03914	245'47670	9'60857	34
35	28'10244	'03558	271'02437	9'64416	35
36	30'91268	'03235	299'12681	9'67651	36
37	34'00395	'02941	330'03949	9'70592	37
38	37'40434	'02673	364'04343	9'73265	38
39	41'14478	'02430	401'44778	9'75696	39
40	45'25926	'02209	442'59256	9'77905	40
41	49'78518	'02009	487'85181	9'79914	41
42	54'76370	'01826	537'63699	9'81740	42
43	60'24007	'01660	592'40069	9'83400	43
44	66'26408	'01509	652'64076	9'84909	44
45	72'89048	'01372	718'90484	9'86281	45
46	80'17953	'01247	791'79532	9'87528	46
47	88'19749	'01134	871'97485	9'88662	47
48	97'01723	'01031	960'17234	9'89693	48
49	106'71896	'00937	1057'18957	9'90630	49
50	117'39085	'00852	1163'90853	9'91481	50

INTEREST TABLES

10%

Years	ONE POUND		ONE POUND PER ANNUM		Years
	Amount	Present Value	Amount	Present Value	
51	129·12994	·00774	1281·29938	9·92256	51
52	142·04293	·00704	1410·42932	9·92960	52
53	156·24723	·00640	1552·47225	9·93600	53
54	171·87195	·00582	1708·71948	9·94182	54
55	189·05914	·00529	1880·59142	9·94711	55
56	207·96506	·00481	2069·65057	9·95191	56
57	228·76156	·00437	2277·61562	9·95629	57
58	251·63772	·00397	2506·37719	9·96026	58
59	276·80149	·00361	2758·01490	9·96387	59
60	304·48164	·00328	3034·81640	9·96716	60
61	334·92980	·00299	3339·29803	9·97014	61
62	368·42278	·00271	3674·22784	9·97286	62
63	405·26506	·00247	4042·65062	9·97532	63
64	445·79157	·00224	4447·91568	9·97757	64
65	490·37073	·00204	4893·70725	9·97961	65
66	539·40780	·00185	5384·07798	9·98146	66
67	593·34858	·00169	5923·48578	9·98315	67
68	652·68344	·00153	6516·83435	9·98468	68
69	717·95178	·00139	7169·51779	9·98607	69
70	789·74696	·00127	7887·46957	9·98734	70
71	868·72165	·00115	8677·21652	9·98849	71
72	955·59382	·00105	9545·93818	9·98954	72
73	1051·15320	·00095	10501·53199	9·99049	73
74	1156·26852	·00086	11552·68519	9·99135	74
75	1271·89537	·00079	12708·95371	9·99214	75
76	1399·08491	·00071	13980·84909	9·99285	76
77	1538·99340	·00065	15379·93399	9·99350	77
78	1692·89274	·00059	16918·92739	9·99409	78
79	1862·18201	·00054	18611·82013	9·99463	79
80	2048·40021	·00049	20474·00215	9·99512	80
81	2253·24024	·00044	22522·40236	9·99556	81
82	2478·56426	·00040	24775·64260	9·99597	82
83	2726·42069	·00037	27254·20686	9·99633	83
84	2999·06275	·00033	29980·62754	9·99667	84
85	3298·96903	·00030	32979·69030	9·99697	85
86	3628·86593	·00028	36278·65932	9·99724	86
87	3991·75253	·00025	39907·52526	9·99749	87
88	4390·92778	·00023	43899·27778	9·99772	88
89	4830·02056	·00021	48290·20556	9·99793	89
90	5313·02261	·00019	53120·22612	9·99812	90
91	5844·32487	·00017	58433·24873	9·99829	91
92	6428·75736	·00016	64277·57360	9·99844	92
93	7071·63310	·00014	70706·33096	9·99859	93
94	7778·79641	·00013	77777·96406	9·99871	94
95	8556·67605	·00012	85556·76046	9·99883	95
96	9412·34365	·00011	94113·43651	9·99894	96
97	10353·57802	·00010	103525·78016	9·99903	97
98	11388·93582	·00009	113879·35818	9·99912	98
99	12527·82940	·00008	125268·29400	9·99920	99
100	13780·61234	·00007	137796·12340	9·99927	100

INTEREST TABLES

TABLE II

SINKING FUND FOR THE REDEMPTION OF CAPITAL

The sinking fund necessary to be invested annually at rate r to produce 1 in n years

$$= \frac{r}{(1 + r)^n - 1} = \frac{r}{R^n - 1} \text{ or } F_n$$

NOTE.—If the sinking fund be invested at shorter periods than 1 year and the interest be convertible at like periods, the sinking fund necessary to be invested at each of the stipulated periods may be obtained from the table giving the rate of interest for the period, the number of periods in the term being substituted for the years in the table. Thus, the sinking fund necessary to be invested half yearly at 4 per cent. to amount to 1 in 10 years, the interest convertible half yearly, is the same as that which will amount to 1 in 20 years if invested at 2 per cent. viz.: '041157. The *annual* sinking fund will be twice this sum or '082314.

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	1 %	1 $\frac{1}{4}$ %	1 $\frac{1}{2}$ %	1 $\frac{3}{4}$ %	Years
1	1'000000	1'000000	1'000000	1'000000	1
2	'497512	'496893	'496278	'495663	2
3	'330022	'329202	'328383	'327567	3
4	'246281	'245361	'244445	'243532	4
5	'196040	'195062	'194089	'193121	5
6	'162548	'161534	'160525	'159523	6
7	'138628	'137589	'136556	'135531	7
8	'120690	'119633	'118584	'117543	8
9	'106740	'105671	'104609	'103558	9
10	'095582	'094503	'093434	'092375	10
11	'086454	'085367	'084294	'083231	11
12	'078849	'077758	'076680	'075614	12
13	'072415	'071321	'070240	'069173	13
14	'066901	'065805	'064723	'063656	14
15	'062124	'061026	'059944	'058877	15
16	'057945	'056847	'055765	'054700	16
17	'054258	'053160	'052080	'051016	17
18	'050982	'049884	'048806	'047745	18
19	'048052	'046955	'045878	'044821	19
20	'045415	'044320	'043246	'042191	20
21	'043031	'041937	'040866	'039815	21
22	'040864	'039770	'038703	'037656	22
23	'038886	'037897	'036731	'035688	23
24	'037073	'035987	'034924	'033886	24
25	'035407	'034322	'033263	'032230	25
26	'033869	'032787	'031732	'030703	26
27	'032446	'031367	'030315	'029291	27
28	'031124	'030049	'029001	'027982	28
29	'029895	'028822	'027779	'026764	29
30	'028748	'027679	'026639	'025630	30
31	'027676	'026609	'025574	'024570	31
32	'026671	'025608	'024577	'023578	32
33	'025728	'024668	'023641	'022648	33
34	'024840	'023784	'022762	'021774	34
35	'024004	'022951	'021934	'020951	35
36	'023214	'022165	'021152	'020175	36
37	'022468	'021424	'020414	'019443	37
38	'021762	'020720	'019716	'018750	38
39	'021092	'020054	'019055	'018094	39
40	'020456	'019421	'018427	'017472	40
41	'019851	'018821	'017831	'016882	41
42	'019276	'018249	'017264	'016321	42
43	'018727	'017705	'016725	'015787	43
44	'018204	'017186	'016210	'015278	44
45	'017705	'016690	'015720	'014793	45
46	'017228	'016217	'015251	'014330	46
47	'016771	'015764	'014803	'013888	47
48	'016334	'015331	'014375	'013466	48
49	'015915	'014916	'013965	'013061	49
50	'015513	'014518	'013572	'012674	50

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	1 %	1 $\frac{1}{4}$ %	1 $\frac{1}{2}$ %	1 $\frac{3}{4}$ %	Years
51	·015127	·014136	·013195	·012303	51
52	·014756	·013769	·012833	·011947	52
53	·014400	·013416	·012485	·011605	53
54	·014057	·013078	·012151	·011277	54
55	·013726	·012751	·011830	·010961	55
56	·013408	·012437	·011521	·010658	56
57	·013102	·012135	·011223	·010366	57
58	·012806	·011843	·010937	·010085	58
59	·012520	·011562	·010660	·009814	59
60	·012244	·011290	·010393	·009553	60
61	·011978	·011028	·010136	·009302	61
62	·011720	·010774	·009888	·009059	62
63	·011471	·010529	·009647	·008825	63
64	·011230	·010292	·009416	·008598	64
65	·010997	·010063	·009191	·008379	65
66	·010771	·009841	·008974	·008168	66
67	·010551	·009626	·008764	·007964	67
68	·010339	·009417	·008560	·007766	68
69	·010133	·009215	·008363	·007575	69
70	·009933	·009019	·008172	·007389	70
71	·009739	·008829	·007987	·007210	71
72	·009550	·008645	·007808	·007036	72
73	·009367	·008466	·007634	·006868	73
74	·009189	·008292	·007465	·006704	74
75	·009016	·008123	·007301	·006546	75
76	·008848	·007959	·007141	·006392	76
77	·008684	·007800	·006987	·006243	77
78	·008525	·007644	·006836	·006098	78
79	·008370	·007493	·006690	·005958	79
80	·008219	·007347	·006548	·005821	80
81	·008072	·007203	·006410	·005688	81
82	·007929	·007064	·006276	·005559	82
83	·007789	·006929	·006145	·005434	83
84	·007653	·006797	·006018	·005312	84
85	·007520	·006668	·005894	·005194	85
86	·007390	·006543	·005773	·005078	86
87	·007264	·006420	·005656	·004966	87
88	·007141	·006301	·005541	·004857	88
89	·007021	·006185	·005430	·004751	89
90	·006903	·006071	·005321	·004648	90
91	·006789	·005961	·005215	·004547	91
92	·006676	·005853	·005112	·004449	92
93	·006567	·005747	·005011	·004353	93
94	·006460	·005644	·004913	·004260	94
95	·006355	·005544	·004817	·004169	95
96	·006253	·005445	·004723	·004081	96
97	·006153	·005349	·004632	·003995	97
98	·006055	·005256	·004543	·003911	98
99	·005959	·005164	·004456	·003829	99
100	·005866	·005074	·004371	·003749	100

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	2 %	2 $\frac{1}{4}$ %	2 $\frac{1}{2}$ %	2 $\frac{3}{4}$ %	Years
1	1'000000	1'000000	1'000000	1'000000	1
2	'495049	'494438	'493827	'493222	2
3	'326755	'325945	'325137	'324332	3
4	'242624	'241719	'240818	'239920	4
5	'192158	'191200	'190247	'189298	5
6	'158526	'157535	'156550	'155571	6
7	'134512	'133500	'132495	'131497	7
8	'116509	'115485	'114467	'113458	8
9	'102515	'101482	'100457	'099441	9
10	'091326	'090288	'089259	'088240	10
11	'082178	'081136	'080106	'079086	11
12	'074560	'073517	'072487	'071469	12
13	'068118	'067077	'066048	'065033	13
14	'062602	'061562	'060536	'059525	14
15	'057825	'056789	'055766	'054759	15
16	'053650	'052617	'051599	'050597	16
17	'049970	'048940	'047928	'046932	17
18	'046702	'045677	'044670	'043681	18
19	'043782	'042762	'041760	'040778	19
20	'041157	'040142	'039147	'038172	20
21	'038785	'037776	'036787	'035819	21
22	'036631	'035628	'034646	'033686	22
23	'034668	'033671	'032696	'031744	23
24	'032871	'031880	'030913	'029969	24
25	'031221	'030236	'029276	'028340	25
26	'029699	'028721	'027768	'026841	26
27	'028293	'027322	'026377	'025458	27
28	'026990	'026025	'025088	'024177	28
29	'025779	'024821	'023891	'022989	29
30	'024650	'023699	'022777	'021884	30
31	'023596	'022653	'021739	'020855	31
32	'022611	'021674	'020768	'019893	32
33	'021687	'020757	'019859	'018993	33
34	'020819	'019897	'019007	'018149	34
35	'020002	'019087	'018205	'017356	35
36	'019233	'018325	'017451	'016611	36
37	'018507	'017606	'016741	'015910	37
38	'017821	'016928	'016070	'015248	38
39	'017171	'016285	'015436	'014623	39
40	'016556	'015677	'014836	'014032	40
41	'015972	'015101	'014268	'013472	41
42	'015417	'014554	'013728	'012942	42
43	'014890	'014034	'013217	'012439	43
44	'014388	'013539	'012730	'011961	44
45	'013910	'013068	'012267	'011507	45
46	'013453	'012619	'011826	'011075	46
47	'013018	'012191	'011407	'010664	47
48	'012602	'011782	'011006	'010272	48
49	'012204	'011392	'010623	'009898	49
50	'011823	'011018	'010258	'009541	50

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	2 %	2 $\frac{1}{4}$ %	2 $\frac{1}{2}$ %	2 $\frac{3}{4}$ %	Years
51	·011459	·010661	·009909	·009200	51
52	·011109	·010319	·009574	·008874	52
53	·010774	·009991	·009254	·008563	53
54	·010452	·009677	·008948	·008265	54
55	·010143	·009375	·008654	·007980	55
56	·009847	·009085	·008373	·007706	56
57	·009561	·008807	·008102	·007444	57
58	·009287	·008540	·007842	·007193	58
59	·009022	·008283	·007593	·006952	59
60	·008768	·008035	·007353	·006720	60
61	·008523	·007797	·007123	·006498	61
62	·008286	·007568	·006901	·006284	62
63	·008058	·007347	·006688	·006079	63
64	·007839	·007134	·006482	·005881	64
65	·007626	·006929	·006285	·005691	65
66	·007421	·006731	·006094	·005508	66
67	·007223	·006540	·005910	·005332	67
68	·007032	·006355	·005733	·005163	68
69	·006847	·006177	·005562	·005000	69
70	·006668	·006005	·005397	·004842	70
71	·006494	·005838	·005238	·004690	71
72	·006327	·005677	·005084	·004544	72
73	·006165	·005522	·004936	·004403	73
74	·006007	·005371	·004792	·004267	74
75	·005855	·005226	·004654	·004136	75
76	·005708	·005085	·004519	·004009	76
77	·005564	·004948	·004390	·003886	77
78	·005426	·004816	·004265	·003768	78
79	·005291	·004688	·004143	·003654	79
80	·005161	·004564	·004026	·003543	80
81	·005034	·004444	·003912	·003437	81
82	·004911	·004327	·003803	·003334	82
83	·004792	·004214	·003696	·003234	83
84	·004676	·004104	·003593	·003137	84
85	·004563	·003998	·003493	·003044	85
86	·004454	·003895	·003396	·002954	86
87	·004348	·003795	·003303	·002867	87
88	·004244	·003697	·003212	·002782	88
89	·004144	·003603	·003124	·002700	89
90	·004046	·003511	·003038	·002621	90
91	·003951	·003422	·002955	·002545	91
92	·003859	·003336	·002875	·002470	92
93	·003769	·003252	·002797	·002399	93
94	·003681	·003170	·002721	·002329	94
95	·003596	·003091	·002648	·002261	95
96	·003513	·003014	·002577	·002196	96
97	·003432	·002939	·002507	·002133	97
98	·003354	·002866	·002440	·002071	98
99	·003277	·002795	·002375	·002012	99
100	·003203	·002726	·002312	·001954	100

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	3 %	3 $\frac{1}{4}$ %	3 $\frac{1}{2}$ %	3 $\frac{3}{4}$ %	Years
1	1'000000	1'000000	1'000000	1'000000	1
2	'492611	'492005	'491400	'490798	2
3	'323530	'322731	'321934	'321140	3
4	'239027	'238137	'237251	'236369	4
5	'188355	'187415	'186481	'185552	5
6	'154598	'153630	'152668	'151712	6
7	'130506	'129522	'128544	'127574	7
8	'112456	'111463	'110477	'109498	8
9	'098434	'097436	'096446	'095465	9
10	'087231	'086231	'085241	'084261	10
11	'078077	'077079	'076092	'075115	11
12	'070462	'069467	'068484	'067512	12
13	'064030	'063039	'062062	'061096	13
14	'058526	'057542	'056571	'055613	14
15	'053767	'052789	'051825	'050876	15
16	'049611	'048640	'047685	'046745	16
17	'045953	'044990	'044043	'043113	17
18	'042709	'041754	'040817	'039897	18
19	'039814	'038868	'037940	'037031	19
20	'037216	'036279	'035361	'034462	20
21	'034872	'033944	'033037	'032149	21
22	'032747	'031829	'030932	'030055	22
23	'030814	'029906	'029019	'028153	23
24	'029047	'028149	'027273	'026419	24
25	'027428	'026539	'025674	'024832	25
26	'025938	'025060	'024205	'023375	26
27	'024564	'023696	'022852	'022033	27
28	'023293	'022435	'021603	'020795	28
29	'022115	'021267	'020445	'019650	29
30	'021019	'020182	'019371	'018588	30
31	'019999	'019172	'018372	'017600	31
32	'019047	'018230	'017442	'016681	32
33	'018156	'017350	'016572	'015824	33
34	'017322	'016526	'015760	'015023	34
35	'016539	'015753	'014998	'014273	35
36	'015804	'015028	'014284	'013571	36
37	'015112	'014346	'013613	'012911	37
38	'014459	'013704	'012982	'012292	38
39	'013844	'013099	'012388	'011709	39
40	'013262	'012528	'011827	'011159	40
41	'012712	'011988	'011298	'010642	41
42	'012192	'011478	'010798	'010153	42
43	'011698	'010994	'010325	'009691	43
44	'011230	'010536	'009878	'009254	44
45	'010785	'010101	'009453	'008841	45
46	'010363	'009688	'009051	'008449	46
47	'009961	'009296	'008669	'008078	47
48	'009578	'008923	'008306	'007726	48
49	'009213	'008568	'007962	'007392	49
50	'008866	'008230	'007634	'007074	50

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	3 %	3 $\frac{1}{4}$ %	3 $\frac{1}{2}$ %	3 $\frac{3}{4}$ %	Years
51	·008534	·007908	·007322	·006772	51
52	·008217	·007601	·007024	·006485	52
53	·007915	·007308	·006741	·006212	53
54	·007626	·007028	·006471	·005952	54
55	·007349	·006761	·006213	·005704	55
56	·007085	·006506	·005967	·005468	56
57	·006831	·006261	·005732	·005242	57
58	·006588	·006028	·005508	·005028	58
59	·006356	·005804	·005294	·004822	59
60	·006133	·005590	·005089	·004627	60
61	·005919	·005385	·004892	·004440	61
62	·005714	·005188	·004705	·004261	62
63	·005517	·005000	·004525	·004090	63
64	·005328	·004819	·004353	·003927	64
65	·005146	·004646	·004188	·003771	65
66	·004971	·004479	·004030	·003621	66
67	·004803	·004320	·003879	·003478	67
68	·004642	·004166	·003734	·003341	68
69	·004486	·004019	·003595	·003210	69
70	·004337	·003877	·003461	·003085	70
71	·004193	·003741	·003333	·002964	71
72	·004054	·003610	·003210	·002849	72
73	·003921	·003484	·003092	·002738	73
74	·003792	·003363	·002978	·002633	74
75	·003668	·003247	·002869	·002531	75
76	·003548	·003135	·002764	·002434	76
77	·003433	·003027	·002664	·002340	77
78	·003322	·002923	·002567	·002250	78
79	·003215	·002823	·002474	·002164	79
80	·003112	·002727	·002385	·002082	80
81	·003012	·002634	·002299	·002003	81
82	·002916	·002545	·002216	·001926	82
83	·002823	·002459	·002137	·001853	83
84	·002733	·002376	·002060	·001783	84
85	·002647	·002295	·001987	·001716	85
86	·002563	·002218	·001916	·001651	86
87	·002482	·002144	·001848	·001589	87
88	·002404	·002072	·001782	·001529	88
89	·002329	·002003	·001719	·001472	89
90	·002256	·001936	·001658	·001416	90
91	·002185	·001872	·001599	·001363	91
92	·002117	·001809	·001543	·001312	92
93	·002051	·001749	·001488	·001263	93
94	·001987	·001691	·001436	·001216	94
95	·001926	·001635	·001385	·001171	95
96	·001866	·001582	·001337	·001127	96
97	·001809	·001529	·001290	·001085	97
98	·001753	·001479	·001245	·001045	98
99	·001699	·001430	·001201	·001006	99
100	·001647	·001384	·001159	·000969	100

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	4 %	4½ %	4½ %	5 %	Years
1	1'000000	1'000000	1'000000	1'000000	1
2	'490196	'489596	'488997	'487805	2
3	'320349	'319559	'318773	'317209	3
4	'235490	'234615	'233744	'232012	4
5	'184627	'183707	'182792	'180975	5
6	'150762	'149817	'148878	'147017	6
7	'126610	'125652	'124701	'122820	7
8	'108528	'107565	'106609	'104722	8
9	'094493	'093529	'092575	'090690	9
10	'083291	'082330	'081379	'079505	10
11	'074149	'073193	'072248	'070389	11
12	'066552	'065603	'064666	'062825	12
13	'060144	'059203	'058275	'056456	13
14	'054669	'053738	'052820	'051024	14
15	'049941	'049020	'048114	'046342	15
16	'045820	'044910	'044015	'042270	16
17	'042199	'041300	'040418	'038699	17
18	'038993	'038107	'037237	'035546	18
19	'036139	'035264	'034407	'032745	19
20	'033582	'032720	'031876	'030243	20
21	'031280	'030431	'029601	'027996	21
22	'029199	'028362	'027546	'025971	22
23	'027309	'026486	'025682	'024137	23
24	'025587	'024776	'023987	'022471	24
25	'024012	'023215	'022439	'020952	25
26	'022567	'021783	'021021	'019564	26
27	'021239	'020467	'019719	'018292	27
28	'020013	'019255	'018521	'017123	28
29	'018880	'018135	'017415	'016046	29
30	'017830	'017098	'016392	'015051	30
31	'016855	'016137	'015443	'014132	31
32	'015949	'015243	'014563	'013280	32
33	'015104	'014411	'013745	'012490	33
34	'014315	'013635	'012982	'011755	34
35	'013577	'012910	'012270	'011072	35
36	'012887	'012232	'011606	'010434	36
37	'012240	'011597	'010984	'009840	37
38	'011632	'011002	'010402	'009284	38
39	'011061	'010444	'009856	'008765	39
40	'010523	'009918	'009343	'008278	40
41	'010017	'009424	'008862	'007822	41
42	'009540	'008959	'008409	'007395	42
43	'009090	'008521	'007982	'006993	43
44	'008665	'008107	'007581	'006616	44
45	'008262	'007717	'007202	'006262	45
46	'007882	'007348	'006845	'005928	46
47	'007522	'006999	'006507	'005614	47
48	'007181	'006669	'006189	'005318	48
49	'006857	'006356	'005887	'005040	49
50	'006550	'006060	'005602	'004777	50

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	4 %	4 $\frac{1}{4}$ %	4 $\frac{1}{2}$ %	5 %	Years
51	·006259	·005779	·005332	·004529	51
52	·005982	·005513	·005077	·004295	52
53	·005719	·005261	·004835	·004073	53
54	·005469	·005021	·004605	·003864	54
55	·005231	·004793	·004388	·003667	55
56	·005005	·004577	·004181	·003480	56
57	·004789	·004371	·003985	·003303	57
58	·004584	·004175	·003799	·003136	58
59	·004388	·003989	·003622	·002978	59
60	·004202	·003812	·003454	·002828	60
61	·004024	·003643	·003295	·002686	61
62	·003854	·003482	·003143	·002552	62
63	·003692	·003329	·002998	·002424	63
64	·003538	·003183	·002861	·002304	64
65	·003390	·003044	·002730	·002189	65
66	·003249	·002912	·002606	·002081	66
67	·003115	·002785	·002488	·001978	67
68	·002986	·002665	·002375	·001880	68
69	·002863	·002549	·002267	·001787	69
70	·002745	·002440	·002165	·001699	70
71	·002633	·002335	·002068	·001616	71
72	·002525	·002234	·001975	·001536	72
73	·002422	·002139	·001886	·001461	73
74	·002323	·002047	·001802	·001390	74
75	·002229	·001960	·001721	·001322	75
76	·002139	·001877	·001644	·001257	76
77	·002052	·001797	·001571	·001196	77
78	·001969	·001721	·001501	·001138	78
79	·001890	·001648	·001434	·001082	79
80	·001814	·001578	·001371	·001030	80
81	·001741	·001511	·001310	·000980	81
82	·001672	·001448	·001252	·000932	82
83	·001605	·001387	·001197	·000887	83
84	·001541	·001329	·001144	·000844	84
85	·001479	·001273	·001093	·000803	85
86	·001420	·001219	·001045	·000764	86
87	·001364	·001168	·000999	·000727	87
88	·001310	·001119	·000955	·000692	88
89	·001258	·001073	·000913	·000659	89
90	·001208	·001028	·000873	·000627	90
91	·001160	·000985	·000835	·000597	91
92	·001114	·000944	·000798	·000568	92
93	·001070	·000905	·000763	·000541	93
94	·001028	·000867	·000730	·000515	94
95	·000987	·000831	·000698	·000490	95
96	·000949	·000796	·000667	·000466	96
97	·000911	·000763	·000638	·000444	97
98	·000875	·000732	·000610	·000423	98
99	·000841	·000701	·000584	·000402	99
100	·000808	·000672	·000558	·000383	100

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	6 %	7 %	8 %	10 %	Years
1	1'000000	1'000000	1'000000	1'000000	1
2	'485437	'483092	'480769	'476190	2
3	'314110	'311052	'308033	'302115	3
4	'228591	'225228	'221921	'215471	4
5	'177396	'173891	'170456	'163798	5
6	'143363	'139796	'136315	'129607	6
7	'119135	'115553	'112072	'105406	7
8	'101036	'097468	'094015	'087444	8
9	'087022	'083486	'080079	'073641	9
10	'075868	'072377	'069029	'062745	10
11	'066793	'063357	'060076	'053963	11
12	'059277	'055902	'052695	'046763	12
13	'052960	'049651	'046522	'040779	13
14	'047585	'044345	'041297	'035746	14
15	'042963	'039795	'036829	'031474	15
16	'038952	'035858	'032977	'027817	16
17	'035445	'032425	'029629	'024664	17
18	'032357	'029413	'026702	'021930	18
19	'029621	'026753	'024128	'019547	19
20	'027185	'024393	'021852	'017460	20
21	'025005	'022289	'019832	'015624	21
22	'023046	'020406	'018032	'014005	22
23	'021278	'018714	'016422	'012572	23
24	'019679	'017189	'014978	'011300	24
25	'018227	'015811	'013679	'010168	25
26	'016904	'014561	'012507	'009159	26
27	'015697	'013426	'011448	'008258	27
28	'014593	'012392	'010489	'007451	28
29	'013580	'011449	'009618	'006728	29
30	'012649	'010586	'008827	'006079	30
31	'011792	'009797	'008107	'005496	31
32	'011002	'009073	'007451	'004972	32
33	'010273	'008408	'006852	'004499	33
34	'009598	'007797	'006304	'004074	34
35	'008974	'007234	'005803	'003689	35
36	'008395	'006715	'005345	'003343	36
37	'007857	'006237	'004924	'003030	37
38	'007358	'005795	'004539	'002747	38
39	'006894	'005387	'004185	'002491	39
40	'006462	'005009	'003860	'002259	40
41	'006059	'004660	'003562	'002050	41
42	'005683	'004336	'003287	'001860	42
43	'005333	'004036	'003034	'001688	43
44	'005006	'003758	'002802	'001532	44
45	'004701	'003499	'002587	'001391	45
46	'004415	'003260	'002390	'001263	46
47	'004148	'003037	'002208	'001147	47
48	'003898	'002831	'002040	'001041	48
49	'003664	'002639	'001886	'000946	49
50	'003444	'002460	'001743	'000859	50

INTEREST TABLES

SINKING FUND FOR THE REPAYMENT OF LOANS

Years	6 %	7 %	8 %	10 %	Years
51	·003239	·002294	·001611	·000780	51
52	·003046	·002139	·001490	·000709	52
53	·002866	·001995	·001377	·000644	53
54	·002696	·001861	·001274	·000585	54
55	·002537	·001736	·001178	·000532	55
56	·002388	·001620	·001090	·000483	56
57	·002247	·001512	·001008	·000439	57
58	·002116	·001411	·000932	·000399	58
59	·001992	·001317	·000862	·000363	59
60	·001876	·001229	·000798	·000329	60
61	·001766	·001147	·000738	·000299	61
62	·001664	·001071	·000683	·000272	62
63	·001567	·001000	·000632	·000247	63
64	·001476	·000934	·000585	·000225	64
65	·001391	·000872	·000541	·000204	65
66	·001310	·000814	·000501	·000186	66
67	·001235	·000760	·000464	·000169	67
68	·001163	·000710	·000429	·000153	68
69	·001096	·000663	·000397	·000139	69
70	·001033	·000620	·000368	·000127	70
71	·000974	·000579	·000340	·000115	71
72	·000918	·000541	·000315	·000105	72
73	·000865	·000505	·000292	·000095	73
74	·000815	·000472	·000270	·000086	74
75	·000769	·000441	·000250	·000079	75
76	·000725	·000412	·000231	·000072	76
77	·000683	·000385	·000214	·000065	77
78	·000644	·000359	·000198	·000059	78
79	·000607	·000336	·000183	·000054	79
80	·000573	·000314	·000170	·000049	80
81	·000540	·000293	·000157	·000044	81
82	·000509	·000274	·000146	·000040	82
83	·000480	·000256	·000135	·000037	83
84	·000453	·000239	·000125	·000033	84
85	·000427	·000223	·000116	·000030	85
86	·000402	·000209	·000107	·000028	86
87	·000380	·000195	·000099	·000025	87
88	·000358	·000182	·000092	·000023	88
89	·000338	·000170	·000085	·000021	89
90	·000318	·000159	·000079	·000019	90
91	·000300	·000149	·000073	·000017	91
92	·000283	·000139	·000067	·000015	92
93	·000267	·000130	·000062	·000014	93
94	·000252	·000121	·000058	·000013	94
95	·000238	·000113	·000053	·000012	95
96	·000224	·000106	·000049	·000011	96
97	·000211	·000099	·000046	·000010	97
98	·000199	·000092	·000042	·000009	98
99	·000188	·000086	·000039	·000008	99
100	·000177	·000081	·000036	·000007	100

APPENDIX

LOGARITHMS

The Value of Logarithms.—The use of logarithms has for its object the simplifying of calculations, which would, without them, be rendered either very much more difficult and involved, or else absolutely incapable of accomplishment. Put into the simplest possible statement, logarithms enable us to convert the operations of multiplication and division into questions involving only addition and subtraction.

Logarithms Defined.—We must first consider what logarithms are. Let us take a very simple example. We know that 5^2 equals 25. In this case 2 (the power) is said to be the logarithm of 25 to the base 5. The logarithm of a number is the power to which a certain base has to be raised to amount to the first number. Now the base to which all logarithms, at any rate all 'common' logarithms, as they are called, are calculated is 10. There are other logarithms, called 'hyperbolic,' which are calculated to another base, but with these we are not at present concerned.

Now, as 10 is the base, it follows that the logarithm (generally written log) of 100 is 2, because 10^2 equals 100; that of 1000 is 3, because 10^3 equals 1000, and so on. Coming down in the scale of tens it will be seen that the log of 10 is 1, because $10^1 = 10$, and coming lower still in the scale it may be taken for granted that the log of 1 is 0, because it can be demonstrated that $10^0 = 1$. It follows

also from the same reasoning that the log of any value below 1 or unity must be negative in value. Let us start with (say) 1000 in the scale of tens and come down, when the above reasoning will probably make itself clear.

10^3	=	1000	or log of	1000	=	3
10^2	=	100	or log of	100	=	2
10^1	=	10	or log of	10	=	1
10^0	=	1	or log of	1	=	0
10^{-1}	=	0.1	or log of	0.1	=	- 1
10^{-2}	=	0.01	or log of	0.01	=	- 2
10^{-3}	=	0.001	or log of	0.001	=	- 3

The table might be continued indefinitely either way, but the above will no doubt suffice. It will be seen from the above that the log of a number above 1 and below 10 will be something less than unity, that is to say, it will consist of a decimal part only. The log of a number between 10 and 100 will be more than 1 and less than 2, that is to say, it will consist of 1 and a decimal part. The log of a number between 100 and 1000 will be more than 2 and less than 3; of a number between 1000 and 10,000, more than 3 and less than 4. Generally we may say that if there be a certain number of figures in the quantity, its logarithm will have one less than that number for its whole number. Thus the log of a number between 1000 and 10,000, that is to say, one containing four figures, has a logarithm more than 3 and less than 4; that is, the whole number part of the log is 3, and this may always be taken for granted. In fact the whole number part (or *characteristic*, as it is called) denotes how many figures there are in the number whose log it may be. It must be told that when we speak of figures we mean whole number figures, or integers, or figures to the left of the decimal point, if there is one. There will always be one more figure in the number or value than the characteristic. The decimal part of a logarithm, or

mantissa, as it is called, denotes the actual figures in the number, and the characteristic denotes their value in the scale of tens. In tables of logarithms the mantissa is given to four, five, six or seven places, according to the degree of accuracy desired.

Explanation of the Tables.—As the characteristic is so easily determined it is unnecessary—and for certain reasons which will be explained later, it is undesirable—to give the characteristic in the tables. In the first column headed ‘No.’ are the natural numbers from 100 to 1000, in the second column headed ‘o’ is to be found the mantissa of the logarithm of the number on the same line.

Thus taking the number 390 (page 132), the mantissa of the logarithm is given in the second column as 591065, and as there are three integers in the number the characteristic is 2, and the full logarithm is 2.591065.

As a further example take the number 370 (page 132); in the second column we have 568202. The full log of 370 will be 2.568202, and this means that 10 must be raised to that uneven power to make 370. Now the log of 3700 will have just the same decimal, because the figures are unaltered, as the cypher being at the end does not affect the *mantissa*, but the characteristic will be increased by 1, as we have another integer in our number, that is to say we have gone up one in the scale of tens. The log of 3700 will therefore be 3.568202.

The following list will perhaps explain this more clearly:—

The log of 3700	=	3.568202
The log of 370	=	2.568202
The log of 37	=	1.568202
The log of 3.7	=	0.568202
The log of .37	=	1̄.568202
The log of .037	=	2̄.568202
The log of .0037	=	3̄.568202

It will be noticed that when the number is below unity, as was observed, previously, the logarithm has a negative value. This is only as regards the characteristic; the mantissa is *always* positive, and must be kept so, and that is why the minus sign is placed *over* the characteristic, to denote that it refers to it only. The actual value of $\bar{1}.5682$ is really $-.4318$, but this negative decimal would give an altogether wrong idea as to the value of the number it represented. It will be seen too that when the number is less than unity, the *negative* value of the characteristic is one greater than the number of cyphers following the decimal point of the number. Strictly speaking, being one greater *negatively* is the same as being one less *positively*, and this is merely following out the general rule explained previously.

To Find the Logarithm of a Number.—It will now be apparent why the characteristic is omitted from the tables. The mantissa is the same for the same figures, and is unaltered by the addition of any number of cyphers either to the right or left hand of the figures.

As explained, when the number consists of not more than three figures, that is any number up to .999 or any greater or less number obtained by adding cyphers to the right or left, the mantissa may be obtained from the second column headed 'o.' If the number consists of four figures of which either the first or last is a cypher, to find the log, find the number corresponding to the first three figures in the first column headed 'No.' The last figure must be sought for at the top of the table, and the log is found *on the same line as the first three figures and in the same column as the last figure*. For example, to find the log of 3907 we turn to the number 390 in the first column, and on the same line and in the column headed 7 we obtain

the figure 591843. The characteristic is known to be 3, therefore the full log is 3·591843.

In the final column of the table headed 'Diff.' the difference between successive logarithms is given. Although the increase of the logarithms is not in arithmetical progression as is that of the numbers, the difference between several logarithms in succession is constant, and although the change in the difference may occur in one of the middle columns of any line, the difference given in the final column may for most practical purposes be taken to apply to all the logarithms in the same line. Thus, again turn to the number 390, the first column of logarithms is 591065 and the second column 591176, the difference in the logarithm is 111, which is the number given in the column of differences. That is to say, the difference between the logarithms of 3900 and 3901 is 111. As the cyphers do not affect the mantissa of the log, it follows that the difference between the log of 39,000 and 39,010 is 111. Now suppose we require the log of a number lying between 39,000 and 39,010, say 39,003 for example. We know from the table that the mantissa of the log of 39,000 is 591065, and adding the characteristic the full log is 4·591065. Now the difference of 10 in the number, that is between 39,000 and 39,010, shows a difference of 111 in the log, so that a difference of 3 in the number may be taken to give a difference of $111 \div 10 \times 3 = 33\cdot3$ in the log. Whence we obtain—

Log of 39000	=	4·591065
Increment for 3	=	333
<hr/>		
Log of 39003	=	4·5910983

Again say the log of a number lying between 390,000 and 390,100 be required; take 390,036 for example. The log of

390,000 is 5·591065 and the log of 390,100 is 5·591176, that is, a difference of 100 in the number gives a difference of 111 in the log, so that a difference of 36 in the number may be taken to give a difference of $111 \div 100 \times 36 = 39\cdot96$ in the log. Whence we obtain—

Log of 390,000	=	5·591065
Increment for 36	=	3996
		<hr/>
Log of 390,036	=	5·59110496

To Find the Number from the Logarithm.—Now take the converse, the logarithm 5·59110496 being given; it is required to find the number. As the 5 on the left of the decimal is the characteristic and merely denotes the whole number in the value required, it may be ignored for the present, and the table is looked up to find the logarithm equal to, or the nearest which is less than ·59110496. This is seen to be ·591065, which has a value of 3900. Thus—

Given log	=	·59110496
Log of 3900	=	·591065
		<hr/>
Difference	=	39·96

As the mantissa of the given logarithm is carried to eight places whereas the differences given in the tables are for six places only, we must point off the difference as determined above to correspond with those given in the tables, all beyond the sixth place being pointed off as decimals. The difference given in the tables in the same line as that from which the log was obtained is 111, and 39·96 divided by 111 gives ·36, which are the next two figures of the value required, making the complete figures

390036. The number of integers now require to be marked off, as all that has yet been determined are the figures in the value. The characteristic is 5, therefore there are six whole numbers in the value, whence the number required is 390036.

Multiplication and Division.—When we wish to multiply two or more numbers together by the aid of logarithms, we find the logarithm of each, that is to say, the power to which 10 must be raised to equal each number, and add all the logarithms together. The total gives us the logarithm of the total product. We refer to a table of logarithms in order to find the logarithm of any number, and we also refer to the same table to find the number represented by any known logarithm. To perform the operation of division we subtract the logarithm of the divisor from that of the dividend, and the remainder gives us the logarithm of the quotient, to find which latter we have again to refer to the tables.

As an example, find the product of 4·72 and 16·8. Opposite 472 we find 673942 and opposite 168 we find 225309. We have one integer in 4·72, so that its log will have no characteristic, while 16·8 has two integers, so that its log will have unity for its characteristic. Whence—

$$\begin{array}{rcl}
 4\cdot72 & = & \log 0\cdot673942 \\
 16\cdot8 & = & \log 1\cdot225309 \\
 & & \hline
 4\cdot72 \times 16\cdot8 & = & \log 1\cdot899251
 \end{array}$$

The logarithm 889251 does not occur in the tables, but the next lower is 899218, which is the log of 7929. In the next column, headed differences, we find the number 55, which divided into 33, the difference between 899251 and 899218, gives '6, which added on after 7929 gives 79296. The characteristic is 1, so that the correct answer is 79·296.

As another example, divide 67.42 by 14.316 .

$$\begin{array}{rcl} 67.42 & = & \log 1.828789 \\ 1431 & = & \log 155640 \end{array}$$

Difference = 303

$$\text{Increment for } 6 = 303 \times .6 = 1818$$

$$14.316 = \log 1.1558218 \quad \underline{1.1558218}$$

$$\begin{array}{rcl} 67.42 \div 14.316 & = & \log .6729672 \\ (\text{From tables}) 4709 & = & \log .672929 \end{array}$$

$$\text{Difference} = \underline{38.2}$$

As the resultant log was $.6729672$ there is one integer in the answer, therefore the answer is 4.709 . If greater accuracy is required we may find the fourth decimal place by dividing the difference 38.2 by the difference given in the table, viz. 92 ; $38.2 \div 92 = .4$. The answer now being 4.7094 .

In the above examples and throughout the preceding chapters the abbreviation, 'log,' has been written alongside the actual logarithm. This method, not an unusual one, has been adopted to clearly distinguish the logarithms from the natural numbers in the problems. More correctly, and perhaps more generally, the word log is written before the natural numbers, thus: $\log 4.72 = 0.673942$, meaning that the logarithm of 4.72 is 0.673942 .

Negative Characteristics.—Addition and subtraction of logarithms with negative characteristics are made in the same manner as is done in algebra. If two negative characteristics have to be added their sum is taken and it is made negative. Thus $\bar{4}$ added to $\bar{3}$ gives $\bar{7}$. To add a positive and a negative characteristic their difference

is taken and it is given the sign of the greater. Thus 4 added to $\bar{3}$ gives 1; $\bar{4}$ and 2 give $\bar{2}$.

Examples—

(1) Add $3\cdot462113$ and $\bar{4}\cdot348161$ <hr style="width: 50%; margin: 0 auto;"/> $\bar{1}\cdot810274$	(2) Add $4\cdot425045$ and $\bar{2}\cdot630201$ <hr style="width: 50%; margin: 0 auto;"/> $3\cdot055246$
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In the last example the sum in the first decimal place is 10 and the 1 is carried to the 4. Then 5 and $\bar{2}$ give 3.

To subtract a negative characteristic, change its sign to plus and add it, as shown in the preceding examples.

Examples—

(1) From $4\cdot425045$ Subtract $\bar{2}\cdot630201$ <hr style="width: 50%; margin: 0 auto;"/> $5\cdot794844$	(2) From $\bar{4}\cdot425045$ Subtract $\bar{2}\cdot630201$ <hr style="width: 50%; margin: 0 auto;"/> $\bar{3}\cdot794844$
--	--

In Ex. 1 there is 1 to carry from the first decimal place, which is to be subtracted from the 4, then 3 and 2 gives 5.

In Ex. 2 the 1 of carriage subtracted from $\bar{4}$ gives $\bar{5}$, and $\bar{5}$ and $\bar{2}$ give 3.

To multiply a logarithm having a negative characteristic multiply the mantissa by the common rule; then multiply the negative characteristic, which will give a negative product. If there is a carriage add it to the characteristic in the manner shown above.

Thus (1) $\bar{3}\cdot356422 \times 2 = \bar{6}\cdot712844$
 (2) $\bar{4}\cdot632146 \times 2 = \bar{7}\cdot8964438$

In Ex. 2: $\bar{4} \times 2 = \bar{8}$ and $\bar{8}$ with the carriage 1 gives $\bar{7}$.

To divide a logarithm having a negative characteristic, if the characteristic is not divisible by the divisor, add such a negative number to it as will make it divisible and prefix

an equal positive integer to the mantissa. Then divide the negative and positive portions separately.

$$\text{Thus (1) } \bar{8}.436218 \div 2 = \bar{4}.218109$$

$$(2) \bar{7}.436218 \div 4 = \bar{8} + 1.436218 \div 4 = \bar{2}.3590545$$

Here $\bar{1}$ must be added to $\bar{7}$ that the sum $\bar{8}$ may be divisible by 4. If 1 is then prefixed to the mantissa the value of the logarithm is unaltered, for there is added $\bar{1}$ and 1 which equal 0.

Involution and Evolution.—The use of logarithms is practically essential when we have to calculate the value of a number raised to any given power, or the root of a number extracted any required number of times. Suppose we wish to find the value of 17 raised to the fourth power. We find from the tables that $17 = \log 1.230449$. Now to find the fourth power of 17 we multiply the log of 17 by the exponent of the power, 4, obtaining thereby the log of the fourth power of 17.

$$17 = \log 1.230449$$

$$\times 4$$

$$17^4 = \log 4.921796$$

We look through the tables and find that the nearest smaller log to 921796 is 921790, which corresponds with the number 8352. There will be five figures in the answer, as the characteristic of the log is 4. We have—

$$17^4 = \log 4.921796$$

$$8352 = \log .921790$$

$$\text{difference} = 6$$

The number in the difference column is 52, which divided into 6 gives 8, which must be annexed to the figures 8352, giving 83521, the fourth power of 17.

Similarly to perform evolution by logarithms the logarithm of the given number must be divided by the exponent of the root, and the quotient will be the logarithm of the required root.

Thus to find the cube root of 1782 :

$$1782 = \log 3.250908$$

$$\text{Its quotient by } 3 = \log 1.083636$$

From the tables we find that the nearest log below .083636 is .083503, which is the log of 1212. The characteristic is 1, therefore the number is 12.12. If the cube root is required more precisely, further decimal places may be found from the differences.

TABLE
OF
THE LOGARITHMS
OF
THE NATURAL NUMBERS
FROM 1 TO 10,000

Log. 000. No. 100.

No.	0	1	2	3	4	Diff.
100	000000	000434	000868	001301	001734	433
101	004321	004751	005181	005609	006038	429
102	008600	009026	009451	009876	010300	425
103	012837	013259	013680	014100	014521	421
104	017033	017451	017868	018284	018700	416
105	021189	021603	022016	022428	022841	412
106	025306	025715	026125	026533	026942	409
107	029384	029789	030195	030600	031004	405
108	033424	033826	034227	034628	035029	401
109	037426	037825	038223	038620	039017	397
110	041393	041787	042182	042576	042969	393
111	045323	045714	046105	046495	046885	390
112	049218	049606	049993	050380	050766	387
113	053078	053463	053846	054230	054613	383
114	056905	057286	057666	058046	058426	380
115	060698	061075	061452	061829	062206	377
116	064458	064832	065206	065580	065953	374
117	068186	068557	068928	069298	069668	370
118	071882	072250	072617	072985	073352	367
119	075547	075912	076276	076640	077004	364
120	079181	079543	079904	080266	080626	361
121	082785	083144	083503	083861	084219	358
122	086360	086716	087071	087426	087781	355
123	089905	090258	090611	090963	091315	352
124	093422	093772	094122	094471	094820	349
125	096910	097257	097604	097951	098298	347
126	100371	100715	101059	101403	101747	344
127	103804	104146	104487	104828	105169	341
128	107210	107549	107888	108227	108565	338
129	110590	110926	111263	111599	111934	336
130	113943	114277	114611	114944	115278	333
131	117271	117603	117934	118265	118595	330
132	120574	120903	121231	121560	121888	328
133	123852	124178	124504	124830	125156	326
134	127105	127429	127753	128076	128399	323
135	130334	130655	130977	131298	131619	321
136	133539	133858	134177	134496	134814	319
137	136721	137037	137354	137671	137987	316
138	139879	140194	140508	140822	141136	314
139	143015	143327	143639	143951	144263	312
140	146128	146438	146748	147058	147367	310
141	149219	149527	149835	150142	150449	307
142	152288	152594	152900	153205	153510	305
143	155336	155640	155943	156246	156549	303
144	158362	158664	158965	159266	159567	301
145	161368	161667	161967	162266	162564	299
146	164353	164650	164947	165244	165541	297
147	167317	167613	167908	168203	168497	295
148	170262	170555	170848	171141	171434	293
149	173186	173478	173769	174060	174351	291

No.	5	6	7	8	9	Diff.
100	002166	002598	003029	003461	003891	431
101	006466	006894	007321	007748	008174	427
102	010724	011147	011570	011993	012415	423
103	014940	015360	015779	016197	016616	419
104	019116	019532	019947	020361	020775	415
105	023252	023664	024075	024486	024896	411
106	027350	027757	028164	028571	028978	407
107	031408	031812	032216	032619	033021	403
108	035430	035830	036230	036629	037028	399
109	039414	039811	040207	040602	040998	396
110	043362	043755	044148	044540	044932	392
111	047275	047664	048053	048442	048830	389
112	051153	051538	051924	052309	052694	385
113	054996	055378	055760	056142	056524	382
114	058805	059185	059563	059942	060320	379
115	062582	062958	063333	063709	064083	375
116	066326	066699	067071	067443	067815	372
117	070038	070407	070776	071145	071514	369
118	073718	074085	074451	074816	075182	366
119	077368	077731	078094	078457	078819	363
120	080987	081347	081707	082067	082426	360
121	084576	084934	085291	085647	086004	357
122	088136	088490	088845	089198	089552	354
123	091667	092018	092370	092721	093071	351
124	095169	095518	095866	096215	096562	348
125	098644	098990	099335	099681	100026	345
126	102091	102434	102777	103119	103462	343
127	105510	105851	106191	106531	106871	340
128	108903	109241	109579	109916	110253	337
129	112270	112605	112940	113275	113609	335
130	115611	115943	116276	116608	116940	332
131	118926	119256	119586	119915	120245	329
132	122216	122544	122871	123198	123525	327
133	125481	125806	126131	126456	126781	325
134	128722	129045	129368	129690	130012	322
135	131939	132260	132580	132900	133219	320
136	135133	135451	135769	136086	136403	318
137	138303	138618	138934	139249	139564	315
138	141450	141763	142076	142389	142702	313
139	144574	144885	145196	145507	145818	311
140	147676	147985	148294	148603	148911	309
141	150756	151063	151370	151676	151982	306
142	153815	154120	154424	154728	155032	304
143	156852	157154	157457	157759	158061	302
144	159868	160168	160469	160769	161068	300
145	162863	163161	163460	163758	164055	298
146	165838	166134	166430	166726	167022	296
147	168792	169086	169380	169674	169968	294
148	171726	172019	172311	172603	172895	292
149	174641	174932	175222	175512	175802	290

Log. 176. No. 150.

No.	0	1	2	3	4	Diff.
150	176091	176381	176670	176959	177248	289
151	178977	179264	179552	179839	180126	287
152	181844	182129	182415	182700	182985	285
153	184691	184975	185259	185542	185825	283
154	187521	187803	188084	188366	188647	281
155	190332	190612	190892	191171	191451	279
156	193125	193403	193681	193959	194237	278
157	195900	196176	196453	196729	197005	276
158	198657	198932	199206	199481	199755	274
159	201397	201670	201943	202216	202488	273
160	204120	204391	204663	204934	205204	271
161	206826	207096	207365	207634	207904	269
162	209515	209783	210051	210319	210586	268
163	212188	212454	212720	212986	213252	266
164	214844	215109	215373	215638	215902	264
165	217484	217747	218010	218273	218536	263
166	220108	220370	220631	220892	221153	261
167	222716	222976	223236	223496	223755	260
168	225309	225568	225826	226084	226342	258
169	227887	228144	228400	228657	228913	257
170	230449	230704	230960	231215	231470	255
171	232996	233250	233504	233757	234011	254
172	235528	235781	236033	236285	236537	252
173	238046	238297	238548	238799	239049	251
174	240549	240799	241048	241297	241546	249
175	243038	243286	243534	243782	244030	248
176	245513	245759	246006	246252	246499	246
177	247973	248219	248464	248709	248954	245
178	250420	250664	250908	251151	251395	244
179	252853	253096	253338	253580	253822	242
180	255273	255514	255755	255996	256237	241
181	257679	257918	258158	258398	258637	240
182	260071	260310	260548	260787	261025	238
183	262451	262688	262925	263162	263399	237
184	264818	265054	265290	265525	265761	236
185	267172	267406	267641	267875	268110	234
186	269513	269746	269980	270213	270446	233
187	271842	272074	272306	272538	272770	232
188	274158	274389	274620	274850	275081	231
189	276462	276692	276921	277151	277380	229
190	278754	278982	279211	279439	279667	228
191	281033	281261	281488	281715	281942	227
192	283301	283527	283753	283979	284205	226
193	285557	285782	286007	286232	286456	225
194	287802	288026	288249	288473	288696	224
195	290035	290257	290480	290702	290925	222
196	292256	292478	292699	292920	293141	221
197	294466	294687	294907	295127	295347	220
198	296665	296884	297104	297323	297542	219
199	298853	299071	299289	299507	299725	218

No.	5	6	7	8	9	Diff.
150	177536	177825	178113	178401	178689	288
151	180413	180699	180986	181272	181558	286
152	183270	183555	183839	184123	184407	284
153	186108	186391	186674	186956	187239	283
154	188928	189209	189490	189771	190051	281
155	191730	192010	192289	192567	192846	279
156	194514	194792	195069	195346	195623	277
157	197281	197556	197832	198107	198382	275
158	200029	200303	200577	200850	201124	274
159	202761	203033	203305	203577	203848	272
160	205475	205746	206016	206286	206556	270
161	208173	208441	208710	208979	209247	269
162	210853	211121	211388	211654	211921	267
163	213518	213783	214049	214314	214579	265
164	216166	216430	216694	216957	217221	264
165	218798	219060	219323	219585	219846	262
166	221414	221675	221936	222196	222456	260
167	224015	224274	224533	224792	225051	259
168	226600	226858	227115	227372	227630	257
169	229170	229426	229682	229938	230193	256
170	231724	231979	232234	232488	232742	254
171	234264	234517	234770	235023	235276	253
172	236789	237041	237292	237544	237795	251
173	239299	239550	239800	240050	240300	250
174	241795	242044	242293	242541	242790	249
175	244277	244525	244772	245019	245266	247
176	246745	246991	247237	247482	247728	246
177	249198	249443	249687	249932	250176	244
178	251638	251881	252125	252368	252610	243
179	254064	254306	254548	254790	255031	242
180	256477	256718	256958	257198	257439	240
181	258877	259116	259355	259594	259833	239
182	261263	261501	261739	261976	262214	238
183	263636	263873	264109	264346	264582	236
184	265996	266232	266467	266702	266937	235
185	268344	268578	268812	269046	269279	234
186	270679	270912	271144	271377	271609	233
187	273001	273233	273464	273696	273927	231
188	275311	275542	275772	276002	276232	230
189	277609	277838	278067	278296	278525	229
190	279895	280123	280351	280578	280806	228
191	282169	282396	282622	282849	283075	226
192	284431	284656	284882	285107	285332	225
193	286681	286905	287130	287354	287578	224
194	288920	289143	289366	289589	289812	223
195	291147	291369	291591	291813	292034	222
196	293363	293584	293804	294025	294246	221
197	295567	295787	296007	296226	296446	220
198	297761	297979	298198	298416	298635	218
199	299943	300161	300378	300595	300813	217

Log. 301. No. 200.

No.	0	1	2	3	4	Diff.
200	301030	301247	301464	301681	301898	217
201	303196	303412	303628	303844	304059	216
202	305351	305566	305781	305996	306211	215
203	307496	307710	307924	308137	308351	214
204	309630	309843	310056	310268	310481	213
205	311754	311966	312177	312389	312600	212
206	313867	314078	314289	314499	314710	211
207	315970	316180	316390	316599	316809	210
208	318063	318272	318481	318689	318898	209
209	320146	320354	320562	320769	320977	208
210	322219	322426	322633	322839	323046	207
211	324282	324488	324694	324899	325105	206
212	326336	326541	326745	326950	327155	205
213	328380	328583	328787	328991	329194	204
214	330414	330617	330819	331022	331225	203
215	332438	332640	332842	333044	333246	202
216	334454	334655	334856	335057	335257	201
217	336460	336660	336860	337060	337260	200
218	338456	338656	338855	339054	339253	199
219	340444	340642	340841	341039	341237	198
220	342423	342620	342817	343014	343212	197
221	344392	344589	344785	344981	345178	196
222	346353	346549	346744	346939	347135	195
223	348305	348500	348694	348889	349083	194
224	350248	350442	350636	350829	351023	194
225	352183	352375	352568	352761	352954	193
226	354108	354301	354493	354685	354876	192
227	356026	356217	356408	356599	356790	191
228	357935	358125	358316	358506	358696	190
229	359835	360025	360215	360404	360593	190
230	361728	361917	362105	362294	362482	189
231	363612	363800	363988	364176	364363	188
232	365488	365675	365862	366049	366236	187
233	367356	367542	367729	367915	368101	186
234	369216	369401	369587	369772	369958	185
235	371068	371253	371437	371622	371806	185
236	372912	373096	373280	373464	373647	184
237	374748	374932	375115	375298	375481	183
238	376577	376759	376942	377124	377306	182
239	378398	378580	378761	378943	379124	182
240	380211	380392	380573	380754	380934	181
241	382017	382197	382377	382557	382737	180
242	383815	383995	384174	384353	384533	179
243	385606	385785	385964	386142	386321	179
244	387390	387568	387746	387923	388101	178
245	389166	389343	389520	389698	389875	177
246	390935	391112	391288	391464	391641	176
247	392697	392873	393048	393224	393400	176
248	394452	394627	394802	394977	395152	175
249	396199	396374	396548	396722	396896	174

Log. 397. No. 249.

No.	5	6	7	8	9	Diff.
200	302114	302331	302547	302764	302980	216
201	304275	304491	304706	304921	305136	215
202	306425	306639	306854	307068	307282	214
203	308564	308778	308991	309204	309417	213
204	310693	310906	311118	311330	311542	212
205	312812	313023	313234	313445	313656	211
206	314920	315130	315340	315551	315760	210
207	317018	317227	317436	317646	317854	209
208	319106	319314	319522	319730	319938	208
209	321184	321391	321598	321805	322012	207
210	323252	323458	323665	323871	324077	206
211	325310	325516	325721	325926	326131	205
212	327359	327563	327767	327972	328176	204
213	329398	329601	329805	330008	330211	203
214	331427	331630	331832	332034	332236	202
215	333447	333649	333850	334051	334253	201
216	335458	335658	335859	336059	336260	200
217	337459	337659	337858	338058	338257	199
218	339451	339650	339849	340047	340246	199
219	341435	341632	341830	342028	342225	198
220	343409	343606	343802	343999	344196	197
221	345374	345570	345766	345962	346157	196
222	347330	347525	347720	347915	348110	195
223	349278	349472	349666	349860	350054	194
224	351216	351410	351603	351796	351989	193
225	353147	353339	353532	353724	353916	192
226	355068	355260	355452	355643	355834	192
227	356981	357172	357363	357554	357744	191
228	358886	359076	359266	359456	359646	190
229	360783	360972	361161	361350	361539	189
230	362671	362859	363048	363236	363424	188
231	364551	364739	364926	365113	365301	187
232	366423	366610	366796	366983	367169	187
233	368287	368473	368659	368845	369030	186
234	370143	370328	370513	370698	370883	185
235	371991	372175	372360	372544	372728	184
236	373831	374015	374198	374382	374565	183
237	375664	375846	376029	376212	376394	183
238	377488	377670	377852	378034	378216	182
239	379306	379487	379668	379849	380030	181
240	381115	381296	381476	381656	381837	180
241	382917	383097	383277	383456	383636	180
242	384712	384891	385070	385249	385428	179
243	386499	386677	386856	387034	387212	178
244	388279	388456	388634	388811	388989	177
245	390051	390228	390405	390582	390759	177
246	391817	391993	392169	392345	392521	176
247	393575	393751	393926	394101	394277	175
248	395326	395501	395676	395850	396025	175
249	397071	397245	397419	397592	397766	174

Log. 397. No. 250.

No.	0	1	2	3	4	Diff.
250	397940	398114	398287	398461	398634	173
251	399674	399847	400020	400192	400365	173
252	401401	401573	401745	401917	402089	172
253	403121	403292	403464	403635	403807	171
254	404834	405005	405176	405346	405517	171
255	406540	406710	406881	407051	407221	170
256	408240	408410	408579	408749	408918	169
257	409933	410102	410271	410440	410609	169
258	411620	411788	411956	412124	412293	168
259	413300	413467	413635	413803	413970	167
260	414973	415140	415307	415474	415641	167
261	416641	416807	416973	417139	417306	166
262	418301	418467	418633	418798	418964	165
263	419956	420121	420286	420451	420616	165
264	421604	421768	421933	422097	422261	164
265	423246	423410	423574	423737	423901	163
266	424882	425045	425208	425371	425534	163
267	426511	426674	426836	426999	427161	162
268	428135	428297	428459	428621	428783	162
269	429752	429914	430075	430236	430398	161
270	431364	431525	431685	431846	432007	160
271	432969	433130	433290	433450	433610	160
272	434569	434729	434888	435048	435207	159
273	436163	436322	436481	436640	436799	159
274	437751	437909	438067	438226	438384	158
275	439333	439491	439648	439806	439964	157
276	440909	441066	441224	441381	441538	157
277	442480	442637	442793	442950	443106	156
278	444045	444201	444357	444513	444669	156
279	445604	445760	445915	446071	446226	155
280	447158	447313	447468	447623	447778	155
281	448706	448861	449015	449170	449324	154
282	450249	450403	450557	450711	450865	154
283	451786	451940	452093	452247	452400	153
284	453318	453471	453624	453777	453930	153
285	454845	454997	455150	455302	455454	152
286	456366	456518	456670	456821	456973	152
287	457882	458033	458184	458336	458487	151
288	459392	459543	459694	459845	459995	151
289	460898	461048	461198	461348	461499	150
290	462398	462548	462697	462847	462997	149
291	463893	464042	464191	464340	464490	149
292	465383	465532	465680	465829	465977	148
293	466868	467016	467164	467312	467460	148
294	468347	468495	468643	468790	468938	147
295	469822	469969	470116	470263	470410	147
296	471292	471438	471585	471732	471878	146
297	472756	472903	473049	473195	473341	146
298	474216	474362	474508	474653	474799	146
299	475671	475816	475962	476107	476252	145

No.	5	6	7	8	9	Diff.
250	398808	398981	399154	399328	399501	173
251	400538	400711	400883	401056	401228	173
252	402261	402433	402605	402777	402949	172
253	403978	404149	404320	404492	404663	171
254	405688	405858	406029	406199	406370	171
255	407391	407561	407731	407901	408070	170
256	409087	409257	409426	409595	409764	169
257	410777	410946	411114	411283	411451	169
258	412461	412629	412796	412964	413132	168
259	414137	414305	414472	414639	414806	167
260	415808	415974	416141	416308	416474	167
261	417472	417638	417804	417970	418135	166
262	419129	419295	419460	419625	419791	165
263	420781	420945	421110	421275	421439	165
264	422426	422590	422754	422918	423082	164
265	424065	424228	424392	424555	424718	163
266	425697	425860	426023	426186	426349	163
267	427324	427486	427648	427811	427973	162
268	428944	429106	429268	429429	429591	162
269	430559	430720	430881	431042	431203	161
270	432167	432328	432488	432649	432809	160
271	433770	433930	434090	434249	434409	160
272	435367	435526	435685	435844	436004	159
273	436957	437116	437275	437433	437592	159
274	438542	438701	438859	439017	439175	158
275	440122	440279	440437	440594	440752	157
276	441695	441852	442009	442166	442323	157
277	443263	443419	443576	443732	443889	156
278	444825	444981	445137	445293	445449	156
279	446382	446537	446692	446848	447003	155
280	447933	448088	448242	448397	448552	155
281	449478	449633	449787	449941	450095	154
282	451018	451172	451326	451479	451633	154
283	452553	452706	452859	453012	453165	153
284	454082	454235	454387	454540	454692	153
285	455606	455758	455910	456062	456214	152
286	457125	457276	457428	457579	457731	152
287	458638	458789	458940	459091	459242	151
288	460146	460296	460447	460597	460748	150
289	461649	461799	461948	462098	462248	150
290	463146	463296	463445	463594	463744	149
291	464639	464788	464936	465085	465234	149
292	466126	466274	466423	466571	466719	148
293	467608	467756	467904	468052	468200	148
294	469085	469233	469380	469527	469675	147
295	470557	470704	470851	470998	471145	147
296	472025	472171	472318	472464	472610	146
297	473487	473633	473779	473925	474071	146
298	474944	475090	475235	475381	475526	146
299	476397	476542	476687	476832	476976	145

Log. 477. No. 300.

No.	0	1	2	3	4	Diff.
300	477121	477266	477411	477555	477700	145
301	478566	478711	478855	478999	479143	144
302	480007	480151	480294	480438	480582	144
303	481443	481586	481729	481872	482016	143
304	482874	483016	483159	483302	483445	143
305	484300	484442	484585	484727	484869	142
306	485721	485863	486005	486147	486289	142
307	487138	487280	487421	487563	487704	141
308	488551	488692	488833	488974	489114	141
309	489958	490099	490239	490380	490520	140
310	491362	491502	491642	491782	491922	140
311	492760	492900	493040	493179	493319	139
312	494155	494294	494433	494572	494711	139
313	495544	495683	495822	495960	496099	138
314	496930	497068	497206	497344	497483	138
315	498311	498448	498586	498724	498862	138
316	499687	499824	499962	500099	500236	137
317	501059	501196	501333	501470	501607	137
318	502427	502564	502700	502837	502973	136
319	503791	503927	504063	504199	504335	136
320	505150	505286	505421	505557	505693	136
321	506505	506640	506776	506911	507046	135
322	507856	507991	508126	508260	508395	135
323	509203	509337	509471	509606	509740	134
324	510545	510679	510813	510947	511081	134
325	511883	512017	512151	512284	512418	133
326	513218	513351	513484	513617	513750	133
327	514548	514681	514813	514946	515079	133
328	515874	516006	516139	516271	516403	132
329	517196	517328	517460	517592	517724	132
330	518514	518646	518777	518909	519040	131
331	519828	519959	520090	520221	520353	131
332	521138	521269	521400	521530	521661	131
333	522444	522575	522705	522835	522966	130
334	523746	523876	524006	524136	524266	130
335	525045	525174	525304	525434	525563	129
336	526339	526469	526598	526727	526856	129
337	527630	527759	527888	528016	528145	129
338	528917	529045	529174	529302	529430	128
339	530200	530328	530456	530584	530712	128
340	531479	531607	531734	531862	531990	128
341	532754	532882	533009	533136	533264	127
342	534026	534153	534280	534407	534534	127
343	535294	535421	535547	535674	535800	126
344	536558	536685	536811	536937	537063	126
345	537819	537945	538071	538197	538322	126
346	539076	539202	539327	539452	539578	125
347	540329	540455	540580	540705	540830	125
348	541579	541704	541829	541953	542078	125
349	542825	542950	543074	543199	543323	124

No.	5	6	7	8	9	Diff.
300	477844	477989	478133	478278	478422	145
301	479287	479431	479575	479719	479863	144
302	480725	480869	481012	481156	481299	144
303	482159	482302	482445	482588	482731	143
304	483587	483730	483872	484015	484157	143
305	485011	485153	485295	485437	485579	142
306	486430	486572	486714	486855	486997	142
307	487845	487986	488127	488269	488410	141
308	489255	489396	489537	489677	489818	141
309	490661	490801	490941	491081	491222	140
310	492062	492201	492341	492481	492621	139
311	493458	493597	493737	493876	494015	139
312	494850	494989	495128	495267	495406	139
313	496238	496376	496515	496653	496791	138
314	497621	497759	497897	498035	498173	138
315	498999	499137	499275	499412	499550	138
316	500374	500511	500648	500785	500922	137
317	501744	501880	502017	502154	502291	137
318	503109	503246	503382	503518	503655	136
319	504471	504607	504743	504878	505014	136
320	505828	505964	506099	506234	506370	136
321	507181	507316	507451	507586	507721	135
322	508530	508664	508799	508934	509068	135
323	509874	510009	510143	510277	510411	134
324	511215	511349	511482	511616	511750	134
325	512551	512684	512818	512951	513084	133
326	513883	514016	514149	514282	514415	133
327	515211	515344	515476	515609	515741	133
328	516535	516668	516800	516932	517064	132
329	517855	517987	518119	518251	518382	132
330	519171	519303	519434	519566	519697	131
331	520484	520615	520745	520876	521007	131
332	521792	521922	522053	522183	522314	131
333	523096	523226	523356	523486	523616	130
334	524396	524526	524656	524785	524915	130
335	525693	525822	525951	526081	526210	129
336	526985	527114	527243	527372	527501	129
337	528274	528402	528531	528660	528788	129
338	529559	529687	529815	529943	530072	128
339	530840	530968	531096	531223	531351	128
340	532117	532245	532372	532500	532627	128
341	533391	533518	533645	533772	533899	127
342	534661	534787	534914	535041	535167	127
343	535927	536053	536180	536306	536432	126
344	537189	537315	537441	537567	537693	126
345	538448	538574	538699	538825	538951	126
346	539703	539829	539954	540079	540204	125
347	540955	541080	541205	541330	541454	125
348	542203	542327	542452	542576	542701	125
349	543447	543571	543696	543820	543944	124

Log. 544. No. 350.

No.	0	1	2	3	4	Diff.
350	544068	544192	544316	544440	544564	124
351	545307	545431	545555	545678	545802	124
352	546543	546666	546789	546913	547036	123
353	547775	547898	548021	548144	548267	123
354	549003	549126	549249	549371	549494	123
355	550228	550351	550473	550595	550717	122
356	551450	551572	551694	551816	551938	122
357	552668	552790	552911	553033	553155	121
358	553883	554004	554126	554247	554368	121
359	555094	555215	555336	555457	555578	121
360	556303	556423	556544	556664	556785	120
361	557507	557627	557748	557868	557988	120
362	558709	558829	558948	559068	559188	120
363	559907	560026	560146	560265	560385	119
364	561101	561221	561340	561459	561578	119
365	562293	562412	562531	562650	562769	119
366	563481	563600	563718	563837	563955	119
367	564666	564784	564903	565021	565139	118
368	565848	565966	566084	566202	566320	118
369	567026	567144	567262	567379	567497	118
370	568202	568319	568436	568554	568671	117
371	569374	569491	569608	569725	569842	117
372	570543	570660	570776	570893	571010	117
373	571709	571825	571942	572058	572174	116
374	572872	572988	573104	573220	573336	116
375	574031	574147	574263	574379	574494	116
376	575188	575303	575419	575534	575650	115
377	576341	576457	576572	576687	576802	115
378	577492	577607	577722	577836	577951	115
379	578639	578754	578868	578983	579097	114
380	579784	579898	580012	580126	580241	114
381	580925	581039	581153	581267	581381	114
382	582063	582177	582291	582404	582518	114
383	583199	583312	583426	583539	583652	113
384	584331	584444	584557	584670	584783	113
385	585461	585574	585686	585799	585912	113
386	586587	586700	586812	586925	587037	112
387	587711	587823	587935	588047	588160	112
388	588832	588944	589056	589167	589279	112
389	589950	590061	590173	590284	590396	112
390	591065	591176	591287	591399	591510	111
391	592177	592288	592399	592510	592621	111
392	593286	593397	593508	593618	593729	111
393	594393	594503	594614	594724	594834	110
394	595496	595606	595717	595827	595937	110
395	596597	596707	596817	596927	597037	110
396	597695	597805	597914	598024	598134	110
397	598791	598900	599009	599119	599228	109
398	599883	599992	600101	600210	600319	109
399	600973	601082	601191	601299	601408	109

Log. 601. No. 399.

No.	5	6	7	8	9	Diff.
350	544688	544812	544936	545060	545183	124
351	545925	546049	546172	546296	546419	124
352	547159	547282	547405	547529	547652	123
353	548389	548512	548635	548758	548881	123
354	549616	549739	549861	549984	550106	123
355	550840	550962	551084	551206	551328	122
356	552060	552181	552303	552425	552547	122
357	553276	553398	553519	553640	553762	121
358	554489	554610	554731	554852	554973	121
359	555699	555820	555940	556061	556182	121
360	556905	557026	557146	557267	557387	120
361	558108	558228	558349	558469	558589	120
362	559308	559428	559548	559667	559787	120
363	560504	560624	560743	560863	560982	119
364	561698	561817	561936	562055	562174	119
365	562887	563006	563125	563244	563362	119
366	564074	564192	564311	564429	564548	119
367	565257	565376	565494	565612	565730	118
368	566437	566555	566673	566791	566909	118
369	567614	567732	567849	567967	568084	118
370	568788	568905	569023	569140	569257	117
371	569959	570076	570193	570309	570426	117
372	571126	571243	571359	571476	571592	117
373	572291	572407	572523	572639	572755	116
374	573452	573568	573684	573800	573915	116
375	574610	574726	574841	574957	575072	116
376	575765	575880	575996	576111	576226	115
377	576917	577032	577147	577262	577377	115
378	578066	578181	578295	578410	578525	115
379	579212	579326	579441	579555	579669	114
380	580355	580469	580583	580697	580811	114
381	581495	581608	581722	581836	581950	114
382	582631	582745	582858	582972	583085	114
383	583765	583879	583992	584105	584218	113
384	584896	585009	585122	585235	585348	113
385	586024	586137	586250	586362	586475	113
386	587149	587262	587374	587486	587599	112
387	588272	588384	588496	588608	588720	112
388	589391	589503	589615	589726	589838	112
389	590507	590619	590730	590842	590953	112
390	591621	591732	591843	591955	592066	111
391	592732	592843	592954	593064	593175	111
392	593840	593950	594061	594171	594282	111
393	594945	595055	595165	595276	595386	110
394	596047	596157	596267	596377	596487	110
395	597146	597256	597366	597476	597586	110
396	598243	598353	598462	598572	598681	110
397	599337	599446	599556	599665	599774	109
398	600428	600537	600646	600755	600864	109
399	601517	601625	601734	601843	601951	109

Log. 602. No. 400.

No.	0	1	2	3	4	Diff.
400	602060	602169	602277	602386	602494	108
401	603144	603253	603361	603469	603577	108
402	604226	604334	604442	604550	604658	108
403	605305	605413	605521	605628	605736	108
404	606381	606489	606596	606704	606811	107
405	607455	607562	607669	607777	607884	107
406	608526	608633	608740	608847	608954	107
407	609594	609701	609808	609914	610021	107
408	610660	610767	610873	610979	611086	106
409	611723	611829	611936	612042	612148	106
410	612784	612890	612996	613102	613207	106
411	613842	613947	614053	614159	614264	106
412	614897	615003	615108	615213	615319	105
413	615950	616055	616160	616265	616370	105
414	617000	617105	617210	617315	617420	105
415	618048	618153	618257	618362	618466	105
416	619093	619198	619302	619406	619511	104
417	620136	620240	620344	620448	620552	104
418	621176	621280	621384	621488	621592	104
419	622214	622318	622421	622525	622628	104
420	623249	623353	623456	623559	623663	103
421	624282	624385	624488	624591	624695	103
422	625312	625415	625518	625621	625724	103
423	626340	626443	626546	626648	626751	103
424	627366	627468	627571	627673	627775	102
425	628389	628491	628593	628695	628797	102
426	629410	629512	629613	629715	629817	102
427	630428	630530	630631	630733	630835	102
428	631444	631545	631647	631748	631849	101
429	632457	632559	632660	632761	632862	101
430	633468	633569	633670	633771	633872	101
431	634477	634578	634679	634779	634880	101
432	635484	635584	635685	635785	635886	100
433	636488	636588	636688	636789	636889	100
434	637490	637590	637690	637790	637890	100
435	638489	638589	638689	638789	638888	100
436	639486	639586	639686	639785	639885	100
437	640481	640581	640680	640779	640879	99
438	641474	641573	641672	641771	641871	99
439	642465	642563	642662	642761	642860	99
440	643453	643551	643650	643749	643847	98
441	644439	644537	644636	644734	644832	98
442	645422	645521	645619	645717	645815	98
443	646404	646502	646600	646698	646796	98
444	647383	647481	647579	647676	647774	98
445	648360	648458	648555	648653	648750	97
446	649335	649432	649530	649627	649724	97
447	650308	650405	650502	650599	650696	97
448	651278	651375	651472	651569	651666	97
449	652246	652343	652440	652536	652633	97

No.	5	6	7	8	9	Diff.
400	602603	602711	602819	602928	603036	108
401	603686	603794	603902	604010	604118	108
402	604766	604874	604982	605089	605197	108
403	605844	605951	606059	606166	606274	108
404	606919	607026	607133	607241	607348	107
405	607991	608098	608205	608312	608419	107
406	609061	609167	609274	609381	609488	107
407	610128	610234	610341	610447	610554	107
408	611192	611298	611405	611511	611617	106
409	612254	612360	612466	612572	612678	106
410	613313	613419	613525	613630	613736	106
411	614370	614475	614581	614686	614792	106
412	615424	615529	615634	615740	615845	105
413	616476	616581	616686	616790	616895	105
414	617525	617629	617734	617839	617943	105
415	618571	618676	618780	618884	618989	105
416	619615	619719	619824	619928	620032	104
417	620656	620760	620864	620968	621072	104
418	621695	621799	621903	622007	622110	104
419	622732	622835	622939	623042	623146	104
420	623766	623869	623973	624076	624179	103
421	624798	624901	625004	625107	625210	103
422	625827	625929	626032	626135	626238	103
423	626853	626956	627058	627161	627263	103
424	627878	627980	628082	628185	628287	102
425	628900	629002	629104	629206	629308	102
426	629919	630021	630123	630224	630326	102
427	630936	631038	631139	631241	631342	102
428	631951	632052	632153	632255	632356	101
429	632963	633064	633165	633266	633367	101
430	633973	634074	634175	634276	634376	101
431	634981	635081	635182	635283	635383	101
432	635986	636087	636187	636287	636388	100
433	636989	637089	637189	637290	637390	100
434	637990	638090	638190	638290	638389	100
435	638988	639088	639188	639287	639387	100
436	639984	640084	640183	640283	640382	100
437	640978	641077	641177	641276	641375	99
438	641970	642069	642168	642267	642366	99
439	642959	643058	643156	643255	643354	99
440	643946	644044	644143	644242	644340	98
441	644931	645029	645127	645226	645324	98
442	645913	646011	646110	646208	646306	98
443	646894	646992	647089	647187	647285	98
444	647872	647969	648067	648165	648262	98
445	648848	648945	649043	649140	649237	97
446	649821	649919	650016	650113	650210	97
447	650793	650890	650987	651084	651181	97
448	651762	651859	651956	652053	652150	97
449	652730	652826	652923	653019	653116	97

Log. 653. No. 450.

No.	0	1	2	3	4	Diff.
450	653213	653309	653405	653502	653598	96
451	654177	654273	654369	654465	654562	96
452	655138	655235	655331	655427	655523	96
453	656098	656194	656290	656386	656482	96
454	657056	657152	657247	657343	657438	96
455	658011	658107	658202	658298	658393	95
456	658965	659060	659155	659250	659346	95
457	659916	660011	660106	660201	660296	95
458	660865	660960	661055	661150	661245	95
459	661813	661907	662002	662096	662191	94
460	662758	662852	662947	663041	663135	94
461	663701	663795	663889	663983	664078	94
462	664642	664736	664830	664924	665018	94
463	665581	665675	665769	665862	665956	94
464	666518	666612	666705	666799	666892	94
465	667453	667546	667640	667733	667826	93
466	668386	668479	668572	668665	668759	93
467	669317	669410	669503	669596	669689	93
468	670246	670339	670431	670524	670617	93
469	671173	671265	671358	671451	671543	93
470	672098	672190	672283	672375	672467	92
471	673021	673113	673205	673297	673390	92
472	673942	674034	674126	674218	674310	92
473	674861	674953	675045	675137	675228	92
474	675778	675870	675962	676053	676145	92
475	676694	676785	676876	676968	677059	91
476	677607	677698	677789	677881	677972	91
477	678518	678609	678700	678791	678882	91
478	679428	679519	679610	679700	679791	91
479	680336	680426	680517	680607	680698	91
480	681241	681332	681422	681513	681603	90
481	682145	682235	682326	682416	682506	90
482	683047	683137	683227	683317	683407	90
483	683947	684037	684127	684217	684307	90
484	684845	684935	685025	685114	685204	90
485	685742	685831	685921	686010	686100	90
486	686636	686726	686815	686904	686994	89
487	687529	687618	687707	687796	687886	89
488	688420	688509	688598	688687	688776	89
489	689309	689398	689486	689575	689664	89
490	690196	690285	690373	690462	690550	89
491	691081	691170	691258	691347	691435	88
492	691965	692053	692142	692230	692318	88
493	692847	692935	693023	693111	693199	88
494	693727	693815	693903	693991	694078	88
495	694605	694693	694781	694868	694956	88
496	695482	695569	695657	695744	695832	87
497	696356	696444	696531	696618	696706	87
498	697229	697317	697404	697491	697578	87
499	698101	698188	698275	698362	698449	87

No.	5	6	7	8	9	Diff.
450	653695	653791	653888	653984	654080	96
451	654658	654754	654850	654946	655042	96
452	655619	655715	655810	655906	656002	96
453	656577	656673	656769	656864	656960	96
454	657534	657629	657725	657820	657916	96
455	658488	658584	658679	658774	658870	95
456	659441	659536	659631	659726	659821	95
457	660391	660486	660581	660676	660771	95
458	661339	661434	661529	661623	661718	95
459	662286	662380	662475	662569	662663	94
460	663230	663324	663418	663512	663607	94
461	664172	664266	664360	664454	664548	94
462	665112	665206	665299	665393	665487	94
463	666050	666143	666237	666331	666424	94
464	666986	667079	667173	667266	667360	94
465	667920	668013	668106	668199	668293	93
466	668852	668945	669038	669131	669224	93
467	669782	669875	669967	670060	670153	93
468	670710	670802	670895	670988	671080	93
469	671636	671728	671821	671913	672005	92
470	672560	672652	672744	672836	672929	92
471	673482	673574	673666	673758	673850	92
472	674402	674494	674586	674677	674769	92
473	675320	675412	675503	675595	675687	92
474	676236	676328	676419	676511	676602	92
475	677151	677242	677333	677424	677516	91
476	678063	678154	678245	678336	678427	91
477	678973	679064	679155	679246	679337	91
478	679882	679973	680063	680154	680245	91
479	680789	680879	680970	681060	681151	91
480	681693	681784	681874	681964	682055	90
481	682596	682686	682777	682867	682957	90
482	683497	683587	683677	683767	683857	90
483	684396	684486	684576	684666	684756	90
484	685294	685383	685473	685563	685652	90
485	686189	686279	686368	686458	686547	90
486	687083	687172	687261	687351	687440	89
487	687975	688064	688153	688242	688331	89
488	688865	688953	689042	689131	689220	89
489	689753	689841	689930	690019	690107	89
490	690639	690728	690816	690905	690993	89
491	691524	691612	691700	691789	691877	88
492	692406	692494	692583	692671	692759	88
493	693287	693375	693463	693551	693639	88
494	694166	694254	694342	694430	694517	88
495	695044	695131	695219	695307	695394	88
496	695919	696007	696094	696182	696269	87
497	696793	696880	696968	697055	697142	87
498	697665	697752	697839	697926	698014	87
499	698535	698622	698709	698796	698883	87

Log. 698. No. 500.

No.	0	1	2	3	4	Diff.
500	698970	699057	699144	699231	699317	87
501	699838	699924	700011	700098	700184	87
502	700704	700790	700877	700963	701050	86
503	701568	701654	701741	701827	701913	86
504	702431	702517	702603	702689	702775	86
505	703291	703377	703463	703549	703635	86
506	704151	704236	704322	704408	704494	86
507	705008	705094	705179	705265	705350	86
508	705864	705949	706035	706120	706206	85
509	706718	706803	706888	706974	707059	85
510	707570	707655	707740	707826	707911	85
511	708421	708506	708591	708676	708761	85
512	709270	709355	709440	709524	709609	85
513	710117	710202	710287	710371	710456	85
514	710963	711048	711132	711217	711301	84
515	711807	711892	711976	712060	712144	84
516	712650	712734	712818	712902	712986	84
517	713491	713575	713659	713742	713826	84
518	714330	714414	714497	714581	714665	84
519	715167	715251	715335	715418	715502	84
520	716003	716087	716170	716254	716337	83
521	716838	716921	717004	717088	717171	83
522	717671	717754	717837	717920	718003	83
523	718502	718585	718668	718751	718834	83
524	719331	719414	719497	719580	719663	83
525	720159	720242	720325	720407	720490	83
526	720986	721068	721151	721233	721316	83
527	721811	721893	721975	722058	722140	82
528	722634	722716	722798	722881	722963	82
529	723456	723538	723620	723702	723784	82
530	724276	724358	724440	724522	724604	82
531	725095	725176	725258	725340	725422	82
532	725912	725993	726075	726156	726238	82
533	726727	726809	726890	726972	727053	81
534	727541	727623	727704	727785	727866	81
535	728354	728435	728516	728597	728678	81
536	729165	729246	729327	729408	729489	81
537	729974	730055	730136	730217	730298	81
538	730782	730863	730944	731024	731105	81
539	731589	731669	731750	731830	731911	81
540	732394	732474	732555	732635	732715	80
541	733197	733278	733358	733438	733518	80
542	733999	734079	734160	734240	734320	80
543	734800	734880	734960	735040	735120	80
544	735599	735679	735759	735838	735918	80
545	736397	736476	736556	736635	736715	80
546	737193	737272	737352	737431	737511	79
547	737987	738067	738146	738225	738305	79
548	738781	738860	738939	739018	739097	79
549	739572	739651	739731	739810	739889	79

No.	5	6	7	8	9	Diff.
500	699404	699491	699578	699664	699751	87
501	700271	700358	700444	700531	700617	87
502	701136	701222	701309	701395	701482	86
503	701999	702086	702172	702258	702344	86
504	702861	702947	703033	703119	703205	86
505	703721	703807	703893	703979	704065	86
506	704579	704665	704751	704837	704922	86
507	705436	705522	705607	705693	705778	86
508	706291	706376	706462	706547	706632	85
509	707144	707229	707315	707400	707485	85
510	707996	708081	708166	708251	708336	85
511	708846	708931	709015	709100	709185	85
512	709694	709779	709863	709948	710033	85
513	710540	710625	710710	710794	710879	85
514	711385	711470	711554	711639	711723	84
515	712229	712313	712397	712481	712566	84
516	713070	713154	713238	713323	713407	84
517	713910	713994	714078	714162	714246	84
518	714749	714833	714916	715000	715084	84
519	715586	715669	715753	715836	715920	84
520	716421	716504	716588	716671	716754	83
521	717254	717338	717421	717504	717587	83
522	718086	718169	718253	718336	718419	83
523	718917	719000	719083	719165	719248	83
524	719745	719828	719911	719994	720077	83
525	720573	720655	720738	720821	720903	83
526	721398	721481	721563	721646	721728	83
527	722222	722305	722387	722469	722552	82
528	723045	723127	723209	723291	723374	82
529	723866	723948	724030	724112	724194	82
530	724685	724767	724849	724931	725013	82
531	725503	725585	725667	725748	725830	82
532	726320	726401	726483	726564	726646	82
533	727134	727216	727297	727379	727460	81
534	727948	728029	728110	728191	728273	81
535	728759	728841	728922	729003	729084	81
536	729570	729651	729732	729813	729893	81
537	730378	730459	730540	730621	730702	81
538	731186	731266	731347	731428	731508	81
539	731991	732072	732152	732233	732313	81
540	732796	732876	732956	733037	733117	80
541	733598	733679	733759	733839	733919	80
542	734400	734480	734560	734640	734720	80
543	735200	735279	735359	735439	735519	80
544	735998	736078	736157	736237	736317	80
545	736795	736874	736954	737034	737113	80
546	737590	737670	737749	737829	737908	79
547	738384	738463	738543	738622	738701	79
548	739177	739256	739335	739414	739493	79
549	739968	740047	740126	740205	740284	79

Log. 740. No. 550.

No.	0	1	2	3	4	Diff.
550	740363	740442	740521	740600	740678	79
551	741152	741230	741309	741388	741467	79
552	741939	742018	742096	742175	742254	79
553	742725	742804	742882	742961	743039	78
554	743510	743588	743667	743745	743823	78
555	744293	744371	744449	744528	744606	78
556	745075	745153	745231	745309	745387	78
557	745855	745933	746011	746089	746167	78
558	746634	746712	746790	746868	746945	78
559	747412	747489	747567	747645	747722	78
560	748188	748266	748343	748421	748498	77
561	748963	749040	749118	749195	749272	77
562	749736	749814	749891	749968	750045	77
563	750508	750586	750663	750740	750817	77
564	751279	751356	751433	751510	751587	77
565	752048	752125	752202	752279	752356	77
566	752816	752893	752970	753047	753123	77
567	753583	753660	753736	753813	753889	77
568	754348	754425	754501	754578	754654	76
569	755112	755189	755265	755341	755417	76
570	755875	755951	756027	756103	756180	76
571	756636	756712	756788	756864	756940	76
572	757396	757472	757548	757624	757700	76
573	758155	758230	758306	758382	758458	76
574	758912	758988	759063	759139	759214	76
575	759668	759743	759819	759894	759970	75
576	760422	760498	760573	760649	760724	75
577	761176	761251	761326	761402	761477	75
578	761928	762003	762078	762153	762228	75
579	762679	762754	762829	762904	762978	75
580	763428	763503	763578	763653	763727	75
581	764176	764251	764326	764400	764475	75
582	764923	764998	765072	765147	765221	75
583	765669	765743	765818	765892	765966	74
584	766413	766487	766562	766636	766710	74
585	767156	767230	767304	767379	767453	74
586	767898	767972	768046	768120	768194	74
587	768638	768712	768786	768860	768934	74
588	769377	769451	769525	769599	769673	74
589	770115	770189	770263	770336	770410	74
590	770852	770926	770999	771073	771146	74
591	771587	771661	771734	771808	771881	73
592	772322	772395	772468	772542	772615	73
593	773055	773128	773201	773274	773348	73
594	773786	773860	773933	774006	774079	73
595	774517	774590	774663	774736	774809	73
596	775246	775319	775392	775465	775538	73
597	775974	776047	776120	776193	776265	73
598	776701	776774	776846	776919	776992	73
599	777427	777499	777572	777644	777717	72

Log. 778. No. 599.

No.	5	6	7	8	9	Diff.
550	740757	740836	740915	740994	741073	79
551	741546	741624	741703	741782	741860	79
552	742332	742411	742489	742568	742647	79
553	743118	743196	743275	743353	743431	78
554	743902	743980	744058	744136	744215	78
555	744684	744762	744840	744919	744997	78
556	745465	745543	745621	745699	745777	78
557	746245	746323	746401	746479	746556	78
558	747023	747101	747179	747256	747334	78
559	747800	747878	747955	748033	748110	78
560	748576	748653	748731	748808	748885	77
561	749350	749427	749504	749582	749659	77
562	750123	750200	750277	750354	750431	77
563	750894	750971	751048	751125	751202	77
564	751664	751741	751818	751895	751972	77
565	752433	752509	752586	752663	752740	77
566	753200	753277	753353	753430	753506	77
567	753966	754042	754119	754195	754272	77
568	754730	754807	754883	754960	755036	76
569	755494	755570	755646	755722	755799	76
570	756256	756332	756408	756484	756560	76
571	757016	757092	757168	757244	757320	76
572	757775	757851	757927	758003	758079	76
573	758533	758609	758685	758761	758836	76
574	759290	759366	759441	759517	759592	76
575	760045	760121	760196	760272	760347	75
576	760799	760875	760950	761025	761101	75
577	761552	761627	761702	761778	761853	75
578	762303	762378	762453	762529	762604	75
579	763053	763128	763203	763278	763353	75
580	763802	763877	763952	764027	764101	75
581	764550	764624	764699	764774	764848	75
582	765296	765370	765445	765520	765594	75
583	766041	766115	766190	766264	766338	74
584	766785	766859	766933	767007	767082	74
585	767527	767601	767675	767749	767823	74
586	768268	768342	768416	768490	768564	74
587	769008	769082	769156	769230	769303	74
588	769746	769820	769894	769968	770042	74
589	770484	770557	770631	770705	770778	74
590	771220	771293	771367	771440	771514	74
591	771955	772028	772102	772175	772248	73
592	772688	772762	772835	772908	772981	73
593	773421	773494	773567	773640	773713	73
594	774152	774225	774298	774371	774444	73
595	774882	774955	775028	775100	775173	73
596	775610	775683	775756	775829	775902	73
597	776338	776411	776483	776556	776629	73
598	777064	777137	777209	777282	777354	73
599	777789	777862	777934	778006	778079	72

Log. 778. No. 600.

No.	0	1	2	3	4	Diff.
600	778151	778224	778296	778368	778441	72
601	778874	778947	779019	779091	779163	72
602	779596	779669	779741	779813	779885	72
603	780317	780389	780461	780533	780605	72
604	781037	781109	781181	781253	781324	72
605	781755	781827	781899	781971	782042	72
606	782473	782544	782616	782688	782759	72
607	783189	783260	783332	783403	783475	71
608	783904	783975	784046	784118	784189	71
609	784617	784689	784760	784831	784902	71
610	785330	785401	785472	785543	785615	71
611	786041	786112	786183	786254	786325	71
612	786751	786822	786893	786964	787035	71
613	787460	787531	787602	787673	787744	71
614	788168	788239	788310	788381	788451	71
615	788875	788946	789016	789087	789157	71
616	789581	789651	789722	789792	789863	70
617	790285	790356	790426	790496	790567	70
618	790988	791059	791129	791199	791269	70
619	791691	791761	791831	791901	791971	70
620	792392	792462	792532	792602	792672	70
621	793092	793162	793231	793301	793371	70
622	793790	793860	793930	794000	794070	70
623	794488	794558	794627	794697	794767	70
624	795185	795254	795324	795393	795463	70
625	795880	795949	796019	796088	796158	69
626	796574	796644	796713	796782	796852	69
627	797268	797337	797406	797475	797545	69
628	797960	798029	798098	798167	798236	69
629	798651	798720	798789	798858	798927	69
630	799341	799409	799478	799547	799616	69
631	800029	800098	800167	800236	800305	69
632	800717	800786	800854	800923	800992	69
633	801404	801472	801541	801609	801678	69
634	802089	802158	802226	802295	802363	69
635	802774	802842	802910	802979	803047	68
636	803457	803525	803594	803662	803730	68
637	804139	804208	804276	804344	804412	68
638	804821	804889	804957	805025	805093	68
639	805501	805569	805637	805705	805773	68
640	806180	806248	806316	806384	806451	68
641	806858	806926	806994	807061	807129	68
642	807535	807603	807670	807738	807806	68
643	808211	808279	808346	808414	808481	67
644	808886	808953	809021	809088	809156	67
645	809560	809627	809694	809762	809829	67
646	810233	810300	810367	810434	810501	67
647	810904	810971	811039	811106	811173	67
648	811575	811642	811709	811776	811843	67
649	812245	812312	812379	812445	812512	67

No.	5	6	7	8	9	Diff.
600	778513	778585	778658	778730	778802	72
601	779236	779308	779380	779452	779524	72
602	779957	780029	780101	780173	780245	72
603	780677	780749	780821	780893	780965	72
604	781396	781468	781540	781612	781684	72
605	782114	782186	782258	782329	782401	72
606	782831	782902	782974	783046	783117	72
607	783546	783618	783689	783761	783832	71
608	784261	784332	784403	784475	784546	71
609	784974	785045	785116	785187	785259	71
610	785686	785757	785828	785899	785970	71
611	786396	786467	786538	786609	786680	71
612	787106	787177	787248	787319	787390	71
613	787815	787885	787956	788027	788098	71
614	788522	788593	788663	788734	788804	71
615	789228	789299	789369	789440	789510	71
616	789933	790004	790074	790144	790215	70
617	790637	790707	790778	790848	790918	70
618	791340	791410	791480	791550	791620	70
619	792041	792111	792181	792252	792322	70
620	792742	792812	792882	792952	793022	70
621	793441	793511	793581	793651	793721	70
622	794139	794209	794279	794349	794418	70
623	794836	794906	794976	795045	795115	70
624	795532	795602	795672	795741	795811	70
625	796227	796297	796366	796436	796505	69
626	796921	796990	797060	797129	797198	69
627	797614	797683	797752	797821	797890	69
628	798305	798374	798443	798513	798582	69
629	798996	799065	799134	799203	799272	69
630	799685	799754	799823	799892	799961	69
631	800373	800442	800511	800580	800648	69
632	801061	801129	801198	801266	801335	69
633	801747	801815	801884	801952	802021	69
634	802432	802500	802568	802637	802705	69
635	803116	803184	803252	803321	803389	68
636	803798	803867	803935	804003	804071	68
637	804480	804548	804616	804685	804753	68
638	805161	805229	805297	805365	805433	68
639	805841	805908	805976	806044	806112	68
640	806519	806587	806655	806723	806790	68
641	807197	807264	807332	807400	807467	68
642	807873	807941	808008	808076	808143	68
643	808549	808616	808684	808751	808818	67
644	809223	809290	809358	809425	809492	67
645	809896	809964	810031	810098	810165	67
646	810569	810636	810703	810770	810837	67
647	811240	811307	811374	811441	811508	67
648	811910	811977	812044	812111	812178	67
649	812579	812646	812713	812780	812847	67

Log. 812. No. 650.

No.	0	1	2	3	4	Diff.
650	812913	812980	813047	813114	813181	67
651	813581	813648	813714	813781	813848	67
652	814248	814314	814381	814447	814514	67
653	814913	814980	815046	815113	815179	66
654	815578	815644	815711	815777	815843	66
655	816241	816308	816374	816440	816506	66
656	816904	816970	817036	817102	817169	66
657	817565	817631	817698	817764	817830	66
658	818226	818292	818358	818424	818490	66
659	818885	818951	819017	819083	819149	66
660	819544	819610	819676	819741	819807	66
661	820201	820267	820333	820399	820464	66
662	820858	820924	820989	821055	821120	66
663	821514	821579	821645	821710	821775	65
664	822168	822233	822299	822364	822430	65
665	822822	822887	822952	823018	823083	65
666	823474	823539	823605	823670	823735	65
667	824126	824191	824256	824321	824386	65
668	824776	824841	824906	824971	825036	65
669	825426	825491	825556	825621	825686	65
670	826075	826140	826204	826269	826334	65
671	826723	826787	826852	826917	826981	65
672	827369	827434	827499	827563	827628	65
673	828015	828080	828144	828209	828273	64
674	828660	828724	828789	828853	828918	64
675	829304	829368	829432	829497	829561	64
676	829947	830011	830075	830139	830204	64
677	830589	830653	830717	830781	830845	64
678	831230	831294	831358	831422	831486	64
679	831870	831934	831998	832062	832126	64
680	832509	832573	832637	832700	832764	64
681	833147	833211	833275	833338	833402	64
682	833784	833848	833912	833975	834039	64
683	834421	834484	834548	834611	834675	64
684	835056	835120	835183	835247	835310	63
685	835691	835754	835817	835881	835944	63
686	836324	836387	836451	836514	836577	63
687	836957	837020	837083	837146	837210	63
688	837588	837652	837715	837778	837841	63
689	838219	838282	838345	838408	838471	63
690	838849	838912	838975	839038	839101	63
691	839478	839541	839604	839667	839729	63
692	840106	840169	840232	840294	840357	63
693	840733	840796	840859	840921	840984	63
694	841359	841422	841485	841547	841610	63
695	841985	842047	842110	842172	842235	62
696	842609	842672	842734	842796	842859	62
697	843233	843295	843357	843420	843482	62
698	843855	843918	843980	844042	844104	62
699	844477	844539	844601	844664	844726	62

No.	5	6	7	8	9	Diff.
650	813247	813314	813381	813448	813514	67
651	813914	813981	814048	814114	814181	67
652	814581	814647	814714	814780	814847	67
653	815246	815312	815378	815445	815511	66
654	815910	815976	816042	816109	816175	66
655	816573	816639	816705	816771	816838	66
656	817235	817301	817367	817433	817499	66
657	817896	817962	818028	818094	818160	66
658	818556	818622	818688	818754	818820	66
659	819215	819281	819346	819412	819478	66
660	819873	819939	820004	820070	820136	66
661	820530	820595	820661	820727	820792	66
662	821186	821251	821317	821382	821448	66
663	821841	821906	821972	822037	822103	65
664	822495	822560	822626	822691	822756	65
665	823148	823213	823279	823344	823409	65
666	823800	823865	823930	823996	824061	65
667	824451	824516	824581	824646	824711	65
668	825101	825166	825231	825296	825361	65
669	825751	825815	825880	825945	826010	65
670	826399	826464	826528	826593	826658	65
671	827046	827111	827175	827240	827305	65
672	827692	827757	827821	827886	827951	65
673	828338	828402	828467	828531	828595	64
674	828982	829046	829111	829175	829239	64
675	829625	829690	829754	829818	829882	64
676	830268	830332	830396	830460	830525	64
677	830909	830973	831037	831102	831166	64
678	831550	831614	831678	831742	831806	64
679	832189	832253	832317	832381	832445	64
680	832828	832892	832956	833020	833083	64
681	833466	833530	833593	833657	833721	64
682	834103	834166	834230	834294	834357	64
683	834739	834802	834866	834929	834993	64
684	835373	835437	835500	835564	835627	63
685	836007	836071	836134	836197	836261	63
686	836641	836704	836767	836830	836894	63
687	837273	837336	837399	837462	837525	63
688	837904	837967	838030	838093	838156	63
689	838534	838597	838660	838723	838786	63
690	839164	839227	839289	839352	839415	63
691	839792	839855	839918	839981	840043	63
692	840420	840482	840545	840608	840671	63
693	841046	841109	841172	841234	841297	63
694	841672	841735	841797	841860	841922	63
695	842297	842360	842422	842484	842547	62
696	842921	842983	843046	843108	843170	62
697	843544	843606	843669	843731	843793	62
698	844166	844229	844291	844353	844415	62
699	844788	844850	844912	844974	845036	62

Log. 845. No. 700.

No.	0	1	2	3	4	Diff.
700	845098	845160	845222	845284	845346	62
701	845718	845780	845842	845904	845966	62
702	846337	846399	846461	846523	846585	62
703	846955	847017	847079	847141	847202	62
704	847573	847634	847696	847758	847819	62
705	848189	848251	848312	848374	848435	62
706	848805	848866	848928	848989	849051	61
707	849419	849481	849542	849604	849665	61
708	850033	850095	850156	850217	850279	61
709	850646	850707	850769	850830	850891	61
710	851258	851320	851381	851442	851503	61
711	851870	851931	851992	852053	852114	61
712	852480	852541	852602	852663	852724	61
713	853090	853150	853211	853272	853333	61
714	853698	853759	853820	853881	853941	61
715	854306	854367	854428	854488	854549	61
716	854913	854974	855034	855095	855156	61
717	855519	855580	855640	855701	855761	61
718	856124	856185	856245	856306	856366	60
719	856729	856789	856850	856910	856970	60
720	857332	857393	857453	857513	857574	60
721	857935	857995	858056	858116	858176	60
722	858537	858597	858657	858718	858778	60
723	859138	859198	859258	859318	859379	60
724	859739	859799	859859	859918	859978	60
725	860338	860398	860458	860518	860578	60
726	860937	860996	861056	861116	861176	60
727	861534	861594	861654	861714	861773	60
728	862131	862191	862251	862310	862370	60
729	862728	862787	862847	862906	862966	60
730	863323	863382	863442	863501	863561	59
731	863917	863977	864036	864096	864155	59
732	864511	864570	864630	864689	864748	59
733	865104	865163	865222	865282	865341	59
734	865696	865755	865814	865874	865933	59
735	866287	866346	866405	866465	866524	59
736	866878	866937	866996	867055	867114	59
737	867467	867526	867585	867644	867703	59
738	868056	868115	868174	868233	868292	59
739	868644	868703	868762	868821	868879	59
740	869232	869290	869349	869408	869466	59
741	869818	869877	869935	869994	870053	59
742	870404	870462	870521	870579	870638	58
743	870989	871047	871106	871164	871223	58
744	871573	871631	871690	871748	871806	58
745	872156	872215	872273	872331	872389	58
746	872739	872797	872855	872913	872972	58
747	873321	873379	873437	873495	873553	58
748	873902	873960	874018	874076	874134	58
749	874482	874540	874598	874656	874714	58

No.	5	6	7	8	9	Diff.
700	845408	845470	845532	845594	845656	62
701	846028	846090	846151	846213	846275	62
702	846646	846708	846770	846832	846894	62
703	847264	847326	847388	847449	847511	62
704	847881	847943	848004	848066	848128	62
705	848497	848559	848620	848682	848743	62
706	849112	849174	849235	849297	849358	61
707	849726	849788	849849	849911	849972	61
708	850340	850401	850462	850524	850585	61
709	850952	851014	851075	851136	851197	61
710	851564	851625	851686	851747	851809	61
711	852175	852236	852297	852358	852419	61
712	852785	852846	852907	852968	853029	61
713	853394	853455	853516	853577	853637	61
714	854002	854063	854124	854185	854245	61
715	854610	854670	854731	854792	854852	61
716	855216	855277	855337	855398	855459	61
717	855822	855882	855943	856003	856064	61
718	856427	856487	856548	856608	856668	60
719	857031	857091	857152	857212	857272	60
720	857634	857694	857755	857815	857875	60
721	858236	858297	858357	858417	858477	60
722	858838	858898	858958	859018	859078	60
723	859439	859499	859559	859619	859679	60
724	860038	860098	860158	860218	860278	60
725	860637	860697	860757	860817	860877	60
726	861236	861295	861355	861415	861475	60
727	861833	861893	861952	862012	862072	60
728	862430	862489	862549	862608	862668	60
729	863025	863085	863144	863204	863263	60
730	863620	863680	863739	863799	863858	59
731	864214	864274	864333	864392	864452	59
732	864808	864867	864926	864985	865045	59
733	865400	865459	865519	865578	865637	59
734	865992	866051	866110	866169	866228	59
735	866583	866642	866701	866760	866819	59
736	867173	867232	867291	867350	867409	59
737	867762	867821	867880	867939	867998	59
738	868350	868409	868468	868527	868586	59
739	868938	868997	869056	869114	869173	59
740	869525	869584	869642	869701	869760	59
741	870111	870170	870228	870287	870345	59
742	870696	870755	870813	870872	870930	58
743	871281	871339	871398	871456	871515	58
744	871865	871923	871981	872040	872098	58
745	872448	872506	872564	872622	872681	58
746	873030	873088	873146	873204	873262	58
747	873611	873669	873727	873785	873844	58
748	874192	874250	874308	874366	874424	58
749	874772	874830	874888	874945	875003	58

Log. 875. No. 750.

No.	0	1	2	3	4	Diff.
750	875061	875119	875177	875235	875293	58
751	875640	875698	875756	875813	875871	58
752	876218	876276	876333	876391	876449	58
753	876795	876853	876910	876968	877026	58
754	877371	877429	877487	877544	877602	58
755	877947	878004	878062	878119	878177	57
756	878522	878579	878637	878694	878752	57
757	879096	879153	879211	879268	879325	57
758	879669	879726	879784	879841	879898	57
759	880242	880299	880356	880413	880471	57
760	880814	880871	880928	880985	881042	57
761	881385	881442	881499	881556	881613	57
762	881955	882012	882069	882126	882183	57
763	882525	882581	882638	882695	882752	57
764	883093	883150	883207	883264	883321	57
765	883661	883718	883775	883832	883888	57
766	884229	884285	884342	884399	884455	57
767	884795	884852	884909	884965	885022	57
768	885361	885418	885474	885531	885587	57
769	885926	885983	886039	886096	886152	56
770	886491	886547	886604	886660	886716	56
771	887054	887111	887167	887223	887280	56
772	887617	887674	887730	887786	887842	56
773	888179	888236	888292	888348	888404	56
774	888741	888797	888853	888909	888965	56
775	889302	889358	889414	889470	889526	56
776	889862	889918	889974	890030	890086	56
777	890421	890477	890533	890589	890645	56
778	890980	891035	891091	891147	891203	56
779	891537	891593	891649	891705	891760	56
780	892095	892150	892206	892262	892317	56
781	892651	892707	892762	892818	892873	56
782	893207	893262	893318	893373	893429	56
783	893762	893817	893873	893928	893984	55
784	894316	894371	894427	894482	894538	55
785	894870	894925	894980	895036	895091	55
786	895423	895478	895533	895588	895644	55
787	895975	896030	896085	896140	896195	55
788	896526	896581	896636	896692	896747	55
789	897077	897132	897187	897242	897297	55
790	897627	897682	897737	897792	897847	55
791	898176	898231	898286	898341	898396	55
792	898725	898780	898835	898890	898944	55
793	899273	899328	899383	899437	899492	55
794	899821	899875	899930	899985	900039	55
795	900367	900422	900476	900531	900586	55
796	900913	900968	901022	901077	901131	55
797	901458	901513	901567	901622	901676	54
798	902003	902057	902112	902166	902221	54
799	902547	902601	902655	902710	902764	54

No.	5	6	7	8	9	Diff.
750	875351	875409	875466	875524	875582	58
751	875929	875987	876045	876102	876160	58
752	876507	876564	876622	876680	876737	58
753	877083	877141	877199	877256	877314	58
754	877659	877717	877774	877832	877889	58
755	878234	878292	878349	878407	878464	57
756	878809	878866	878924	878981	879039	57
757	879383	879440	879497	879555	879612	57
758	879956	880013	880070	880127	880185	57
759	880528	880585	880642	880699	880756	57
760	881099	881156	881213	881271	881328	57
761	881670	881727	881784	881841	881898	57
762	882240	882297	882354	882411	882468	57
763	882809	882866	882923	882980	883037	57
764	883377	883434	883491	883548	883605	57
765	883945	884002	884059	884115	884172	57
766	884512	884569	884625	884682	884739	57
767	885078	885135	885192	885248	885305	57
768	885644	885700	885757	885813	885870	57
769	886209	886265	886321	886378	886434	56
770	886773	886829	886885	886942	886998	56
771	887336	887392	887449	887505	887561	56
772	887898	887955	888011	888067	888123	56
773	888460	888516	888573	888629	888685	56
774	889021	889077	889134	889190	889246	56
775	889582	889638	889694	889750	889806	56
776	890141	890197	890253	890309	890365	56
777	890700	890756	890812	890868	890924	56
778	891259	891314	891370	891426	891482	56
779	891816	891872	891928	891983	892039	56
780	892373	892429	892484	892540	892595	56
781	892929	892985	893040	893096	893151	56
782	893484	893540	893595	893651	893706	56
783	894039	894094	894150	894205	894261	55
784	894593	894648	894704	894759	894814	55
785	895146	895201	895257	895312	895367	55
786	895699	895754	895809	895864	895920	55
787	896251	896306	896361	896416	896471	55
788	896802	896857	896912	896967	897022	55
789	897352	897407	897462	897517	897572	55
790	897902	897957	898012	898067	898122	55
791	898451	898506	898561	898615	898670	55
792	898999	899054	899109	899164	899218	55
793	899547	899602	899656	899711	899766	55
794	900094	900149	900203	900258	900312	55
795	900640	900695	900749	900804	900859	55
796	901186	901240	901295	901349	901404	55
797	901731	901785	901840	901894	901948	54
798	902275	902329	902384	902438	902492	54
799	902818	902873	902927	902981	903036	54

Log. 903. No. 800.

No.	0	1	2	3	4	Diff.
800	903090	903144	903199	903253	903307	54
801	903633	903687	903741	903795	903849	54
802	904174	904229	904283	904337	904391	54
803	904716	904770	904824	904878	904932	54
804	905256	905310	905364	905418	905472	54
805	905796	905850	905904	905958	906012	54
806	906335	906389	906443	906497	906551	54
807	906874	906927	906981	907035	907089	54
808	907411	907465	907519	907573	907626	54
809	907949	908002	908056	908110	908163	54
810	908485	908539	908592	908649	908699	54
811	909021	909074	909128	909181	909235	54
812	909556	909610	909663	909716	909770	53
813	910091	910144	910197	910251	910304	53
814	910624	910678	910731	910784	910838	53
815	911158	911211	911264	911317	911371	53
816	911690	911743	911797	911850	911903	53
817	912222	912275	912328	912381	912435	53
818	912753	912806	912859	912913	912966	53
819	913284	913337	913390	913443	913496	53
820	913814	913867	913920	913973	914026	53
821	914343	914396	914449	914502	914555	53
822	914872	914925	914977	915030	915083	53
823	915400	915453	915505	915558	915611	53
824	915927	915980	916033	916085	916138	53
825	916454	916507	916559	916612	916664	53
826	916980	917033	917085	917138	917190	53
827	917506	917558	917611	917663	917716	52
828	918030	918083	918135	918188	918240	52
829	918555	918607	918659	918712	918764	52
830	919078	919130	919183	919235	919287	52
831	919601	919653	919706	919758	919810	52
832	920123	920176	920228	920280	920332	52
833	920645	920697	920749	920801	920853	52
834	921166	921218	921270	921322	921374	52
835	921686	921738	921790	921842	921894	52
836	922206	922258	922310	922362	922414	52
837	922725	922777	922829	922881	922933	52
838	923244	923296	923348	923399	923451	52
839	923762	923814	923865	923917	923969	52
840	924279	924331	924383	924434	924486	52
841	924796	924848	924899	924951	925003	52
842	925312	925364	925415	925467	925518	52
843	925828	925879	925931	925982	926034	51
844	926342	926394	926445	926497	926548	51
845	926857	926908	926959	927011	927062	51
846	927370	927422	927473	927524	927576	51
847	927883	927935	927986	928037	928088	51
848	928396	928447	928498	928549	928601	51
849	928908	928959	929010	929061	929112	51

Log. 929. No. 849.

No.	5	6	7	8	9	Diff.
800	903361	903416	903470	903524	903578	54
801	903904	903958	904012	904066	904120	54
802	904445	904499	904553	904607	904661	54
803	904986	905040	905094	905148	905202	54
804	905526	905580	905634	905688	905742	54
805	906066	906119	906173	906227	906281	54
806	906604	906658	906712	906766	906820	54
807	907143	907196	907250	907304	907358	54
808	907680	907734	907787	907841	907895	54
809	908217	908270	908324	908378	908431	54
810	908753	908807	908860	908914	908967	54
811	909289	909342	909396	909449	909503	54
812	909823	909877	909930	909984	910037	53
813	910358	910411	910464	910518	910571	53
814	910891	910944	910998	911051	911104	53
815	911424	911477	911530	911584	911637	53
816	911956	912009	912063	912116	912169	53
817	912488	912541	912594	912647	912700	53
818	913019	913072	913125	913178	913231	53
819	913549	913602	913655	913708	913761	53
820	914079	914132	914184	914237	914290	53
821	914608	914660	914713	914766	914819	53
822	915136	915189	915241	915294	915347	53
823	915664	915716	915769	915822	915875	53
824	916191	916243	916296	916349	916401	53
825	916717	916770	916822	916875	916927	53
826	917243	917295	917348	917400	917453	53
827	917768	917820	917873	917925	917978	52
828	918293	918345	918397	918450	918502	52
829	918816	918869	918921	918973	919026	52
830	919340	919392	919444	919496	919549	52
831	919862	919914	919967	920019	920071	52
832	920384	920436	920489	920541	920593	52
833	920906	920958	921010	921062	921114	52
834	921426	921478	921530	921582	921634	52
835	921946	921998	922050	922102	922154	52
836	922466	922518	922570	922622	922674	52
837	922985	923037	923089	923140	923192	52
838	923503	923555	923607	923658	923710	52
839	924021	924072	924124	924176	924228	52
840	924538	924589	924641	924693	924744	52
841	925054	925106	925157	925209	925261	52
842	925570	925621	925673	925725	925776	52
843	926085	926137	926188	926240	926291	51
844	926600	926651	926702	926754	926805	51
845	927114	927165	927216	927268	927319	51
846	927627	927678	927730	927781	927832	51
847	928140	928191	928242	928293	928345	51
848	928652	928703	928754	928805	928857	51
849	929163	929215	929266	929317	929368	51

Log. 929. No. 850.

No.	0	1	2	3	4	Diff.
850	929419	929470	929521	929572	929623	51
851	929930	929981	930032	930083	930134	51
852	930440	930491	930542	930592	930643	51
853	930949	931000	931051	931102	931153	51
854	931458	931509	931560	931610	931661	51
855	931966	932017	932068	932118	932169	51
856	932474	932524	932575	932626	932677	51
857	932981	933031	933082	933133	933183	51
858	933487	933538	933589	933639	933690	51
859	933993	934044	934094	934145	934195	51
860	934498	934549	934599	934650	934700	50
861	935003	935054	935104	935154	935205	50
862	935507	935558	935608	935658	935709	50
863	936011	936061	936111	936162	936212	50
864	936514	936564	936614	936665	936715	50
865	937016	937066	937117	937167	937217	50
866	937518	937568	937618	937668	937718	50
867	938019	938069	938119	938169	938219	50
868	938520	938570	938620	938670	938720	50
869	939020	939070	939120	939170	939220	50
870	939519	939569	939619	939669	939719	50
871	940018	940068	940118	940168	940218	50
872	940516	940566	940616	940666	940716	50
873	941014	941064	941114	941163	941213	50
874	941511	941561	941611	941660	941710	50
875	942008	942058	942107	942157	942207	50
876	942504	942554	942603	942653	942702	50
877	943000	943049	943099	943148	943198	49
878	943495	943544	943593	943643	943692	49
879	943989	944038	944088	944137	944186	49
880	944483	944532	944581	944631	944680	49
881	944976	945025	945074	945124	945173	49
882	945469	945518	945567	945616	945665	49
883	945961	946010	946059	946108	946157	49
884	946452	946501	946551	946600	946649	49
885	946943	946992	947041	947090	947140	49
886	947434	947483	947532	947581	947630	49
887	947924	947973	948022	948070	948119	49
888	948413	948462	948511	948560	948609	49
889	948902	948951	948999	949048	949097	49
890	949390	949439	949488	949536	949585	49
891	949878	949926	949975	950024	950073	49
892	950365	950414	950462	950511	950560	49
893	950851	950900	950949	950997	951046	49
894	951338	951386	951435	951483	951532	49
895	951823	951872	951920	951969	952017	48
896	952308	952356	952405	952453	952502	48
897	952792	952841	952889	952938	952986	48
898	953276	953325	953373	953421	953470	48
899	953760	953808	953856	953905	953953	48

No.	5	6	7	8	9	Diff.
850	929674	929725	929776	929827	929879	51
851	930185	930236	930287	930338	930389	51
852	930694	930745	930796	930847	930898	51
853	931204	931254	931305	931356	931407	51
854	931712	931763	931814	931865	931915	51
855	932220	932271	932322	932372	932423	51
856	932727	932778	932829	932879	932930	51
857	933234	933285	933335	933386	933437	51
858	933740	933791	933841	933892	933943	51
859	934246	934296	934347	934397	934448	51
860	934751	934801	934852	934902	934953	50
861	935255	935306	935356	935406	935457	50
862	935759	935809	935860	935910	935960	50
863	936262	936313	936363	936413	936463	50
864	936765	936815	936865	936916	936966	50
865	937267	937317	937367	937418	937468	50
866	937769	937819	937869	937919	937969	50
867	938269	938320	938370	938420	938470	50
868	938770	938820	938870	938920	938970	50
869	939270	939320	939369	939419	939469	50
870	939769	939819	939869	939918	939968	50
871	940267	940317	940367	940417	940467	50
872	940765	940815	940865	940915	940964	50
873	941263	941313	941362	941412	941462	50
874	941760	941809	941859	941909	941958	50
875	942256	942306	942355	942405	942455	50
876	942752	942801	942851	942901	942950	50
877	943247	943297	943346	943396	943445	49
878	943742	943791	943841	943890	943939	49
879	944236	944285	944335	944384	944433	49
880	944729	944779	944828	944877	944927	49
881	945222	945272	945321	945370	945419	49
882	945715	945764	945813	945862	945912	49
883	946207	946256	946305	946354	946403	49
884	946698	946747	946796	946845	946894	49
885	947189	947238	947287	947336	947385	49
886	947679	947728	947777	947826	947875	49
887	948168	948217	948266	948315	948364	49
888	948657	948706	948755	948804	948853	49
889	949146	949195	949244	949292	949341	49
890	949634	949683	949731	949780	949829	49
891	950121	950170	950219	950267	950316	49
892	950608	950657	950706	950754	950803	49
893	951095	951143	951192	951240	951289	49
894	951580	951629	951677	951726	951775	49
895	952066	952114	952163	952211	952260	48
896	952550	952599	952647	952696	952744	48
897	953034	953083	953131	953180	953228	48
898	953518	953566	953615	953663	953711	48
899	954001	954049	954098	954146	954194	48

Log. 954. No. 900.

No.	0	1	2	3	4	Diff.
900	954243	954291	954339	954387	954435	48
901	954725	954773	954821	954869	954918	48
902	955207	955255	955303	955351	955399	48
903	955688	955736	955784	955832	955880	48
904	956168	956216	956265	956313	956361	48
905	956649	956697	956745	956793	956840	48
906	957128	957176	957224	957272	957320	48
907	957607	957655	957703	957751	957799	48
908	958086	958134	958181	958229	958277	48
909	958564	958612	958659	958707	958755	48
910	959041	959089	959137	959185	959232	48
911	959518	959566	959614	959661	959709	48
912	959995	960042	960090	960138	960185	48
913	960471	960518	960566	960613	960661	48
914	960946	960994	961041	961089	961136	47
915	961421	961469	961516	961563	961611	47
916	961895	961943	961990	962038	962085	47
917	962369	962417	962464	962511	962559	47
918	962843	962890	962937	962985	963032	47
919	963316	963363	963410	963457	963504	47
920	963788	963835	963882	963929	963977	47
921	964260	964307	964354	964401	964448	47
922	964731	964778	964825	964872	964919	47
923	965202	965249	965296	965343	965390	47
924	965672	965719	965766	965813	965860	47
925	966142	966189	966236	966283	966329	47
926	966611	966658	966705	966752	966799	47
927	967080	967127	967173	967220	967267	47
928	967548	967595	967642	967688	967735	47
929	968016	968062	968109	968156	968203	47
930	968483	968530	968576	968623	968670	47
931	968950	968996	969043	969090	969136	47
932	969416	969463	969509	969556	969602	47
933	969882	969928	969975	970021	970068	47
934	970347	970393	970440	970486	970533	46
935	970812	970858	970904	970951	970997	46
936	971276	971322	971369	971415	971461	46
937	971740	971786	971832	971879	971925	46
938	972203	972249	972295	972342	972388	46
939	972666	972712	972758	972804	972851	46
940	973128	973174	973220	973266	973313	46
941	973590	973636	973682	973728	973774	46
942	974051	974097	974143	974189	974235	46
943	974512	974558	974604	974650	974696	46
944	974972	975018	975064	975110	975156	46
945	975432	975478	975524	975570	975616	46
946	975891	975937	975983	976029	976075	46
947	976350	976396	976442	976488	976533	46
948	976808	976854	976900	976946	976992	46
949	977266	977312	977358	977403	977449	46

No.	5	6	7	8	9	Diff.
900	954484	954532	954580	954628	954677	48
901	954966	955014	955062	955110	955158	48
902	955447	955495	955543	955592	955640	48
903	955928	955976	956024	956072	956120	48
904	956409	956457	956505	956553	956601	48
905	956888	956936	956984	957032	957080	48
906	957368	957416	957464	957512	957559	48
907	957847	957894	957942	957990	958038	48
908	958325	958373	958421	958468	958516	48
909	958803	958850	958898	958946	958994	48
910	959280	959328	959375	959423	959471	48
911	959757	959804	959852	959900	959947	48
912	960233	960280	960328	960376	960423	48
913	960709	960756	960804	960851	960899	48
914	961184	961231	961279	961326	961374	47
915	961658	961706	961753	961801	961848	47
916	962132	962180	962227	962275	962322	47
917	962606	962653	962701	962748	962795	47
918	963079	963126	963174	963221	963268	47
919	963552	963599	963646	963693	963741	47
920	964024	964071	964118	964165	964212	47
921	964495	964542	964590	964637	964684	47
922	964966	965013	965061	965108	965155	47
923	965437	965484	965531	965578	965625	47
924	965907	965954	966001	966048	966095	47
925	966376	966423	966470	966517	966564	47
926	966845	966892	966939	966986	967033	47
927	967314	967361	967408	967454	967501	47
928	967782	967829	967875	967922	967969	47
929	968249	968296	968343	968390	968436	47
930	968716	968763	968810	968856	968903	47
931	969183	969229	969276	969323	969369	47
932	969649	969695	969742	969789	969835	47
933	970114	970161	970207	970254	970300	47
934	970579	970626	970672	970719	970765	46
935	971044	971090	971137	971183	971229	46
936	971508	971554	971601	971647	971693	46
937	971971	972018	972064	972110	972157	46
938	972434	972481	972527	972573	972619	46
939	972897	972943	972989	973035	973082	46
940	973359	973405	973451	973497	973543	46
941	973820	973866	973913	973959	974005	46
942	974281	974327	974374	974420	974466	46
943	974742	974788	974834	974880	974926	46
944	975202	975248	975294	975340	975386	46
945	975662	975707	975753	975799	975845	46
946	976121	976167	976212	976258	976304	46
947	976579	976625	976671	976717	976763	46
948	977037	977083	977129	977175	977220	46
949	977495	977541	977586	977632	977678	46

Log. 977. No. 950.

No.	0	1	2	3	4	Diff.
950	977724	977769	977815	977861	977906	46
951	978181	978226	978272	978317	978363	46
952	978637	978683	978728	978774	978819	46
953	979093	979138	979184	979230	979275	46
954	979548	979594	979639	979685	979730	46
955	980003	980049	980094	980140	980185	45
956	980458	980503	980549	980594	980640	45
957	980912	980957	981003	981048	981093	45
958	981366	981411	981456	981501	981547	45
959	981819	981864	981909	981954	982000	45
960	982271	982316	982362	982407	982452	45
961	982723	982769	982814	982859	982904	45
962	983175	983220	983265	983310	983356	45
963	983626	983671	983716	983762	983807	45
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